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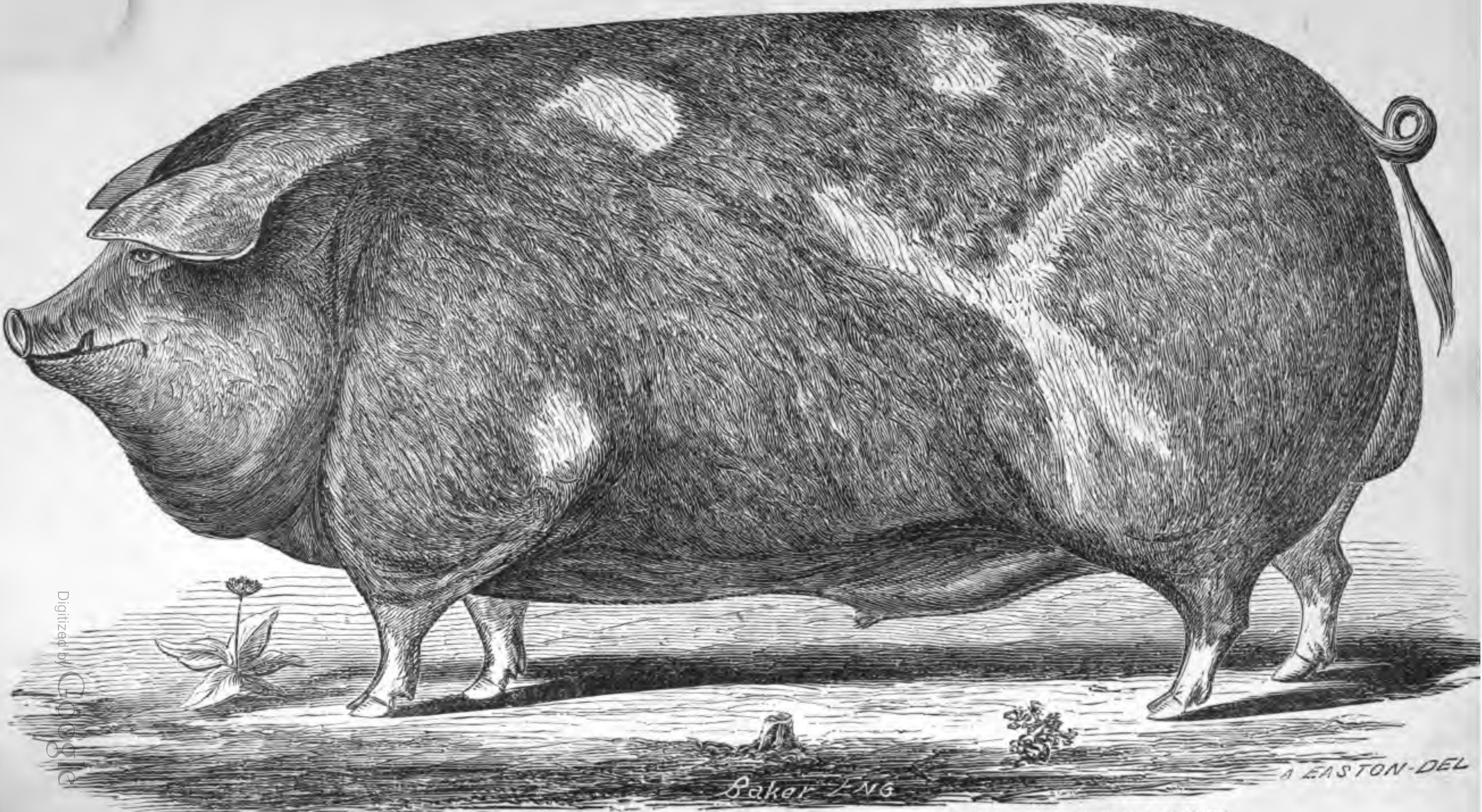
CHRISTO ET ECCLESIAE

The Gift of
Charles Louis Flint,
Sec'y of the Massachusetts
Board of Agriculture.
(H. U. 1849.)
12 Aug. 1872.



"JACK DOWNING." POLAND CHINA BOAR, OWNED BY SHEPARD & ALEXANDER, CHARLESTON, ILLINOIS.

Anal.

SIXTH ANNUAL REPORT

OF THE

Missouri STATE BOARD

OF

AGRICULTURE

WITH AN

ABSTRACT OF THE PROCEEDINGS

OF THE

COUNTY AGRICULTURAL SOCIETIES

FOR THE YEAR 1870.

EDITED BY CHAS. W. MURTFELDT,
Corresponding Secretary.

JEFFERSON CITY, MO.:
HORACE WILCOX, PUBLIC PRINTER.
1871.

Sci 1635.52

1872, Aug. 12.
Gift of
Chas. Louis Flint,
Secy of the Mass. Board
of Agriculture. (H.U. 1849.)

To the General Assembly of the State of Missouri:

The following report embracing the proceedings of the Missouri State Board of Agriculture for the first year, an abstract of the reports and proccedings of the several Agricultural societies, as well as a general view of the condition of agriculture throughout the State, is very respectfully submitted.

MEMBERS OF THE STATE BOARD OF AGRICULTURE FOR 1871.

GOV. B. GRATZ BROWN	Ex-officio members.
IRA DIVOLL, State Superintendent Public Schools	
HENRY T. MUDD, President	Kirkwood.
JOHN W. HARRIS, Vice President	Rocheport.
WM. T. ESSEX, Treasurer	Kirkwood.
Dr. W. S. DYER	Vineland.
GEORGE HUSMANN	Bluffton.
N. J. COLMAN	St. Louis.
WILLIAM STARK	Louisiana.
O. H. P. LEAR	Hannibal.
Judge JOHN F. WIELANDY	Jefferson City.
BARNABAS SMITH	Cuba.
G. W. KINNEY	Snow Hill.
Judge JAMES MOORE	Union.
JOHN H. TICE, Recording Secretary	St. Louis.
CHAS. W. MURTFELDT, Corresponding Secretary	St. Louis.

NOTICE.

The careful and impartial reader cannot fail to observe that the State Board of Agriculture has, within the past year, assumed a higher and more advanced position than at any previous time during its history. The transactions of the Board at its annual meeting foreshadow great advantages to the State, if the people will second these efforts. The machine trials held under the auspices of the Board have also been of practical results to the farmer, and will exert an influence for good for many years to come.

The Corresponding Secretary is very conscious that the experience gained by the members of the Board, as well as himself, in conducting a field trial of Reapers and Mowers (a brief account of which will be found in this report), will result in more systematic and thorough efforts, should a similar trial be determined on by the Board.

It is worthy of remark that the County Reports found in this volume show a much better comprehension on the part of correspondents of what is really desirable, either as a report from a County Agricultural Society, or a statistical report of a county, than former efforts. In the material development of any State, the great demand is for MEN—LIVE MEN. Let the advantages of a county be set forth in a truthful, plain and simple manner, and without exaggeration, and reflecting immigrants will find no difficulty in making an intelligent choice for a future home.

It was hoped that all the Railroad Companies in the State would have responded with equal promptness as those whose reports are found within. Such detailed reports would make an interesting exhibit, and would show the great channels of trade and commerce, and *the direction* which the produce of the State takes on its way to the great marts of this and other countries.

The other papers introduced by the Corresponding Secretary are full of valuable practical information, and must be allowed to speak for themselves.

It is with unfeigned pleasure that the writer records the fact that the labors of the State Horticultural Society in the development of their special field have at last been acknowledged by our General Assembly, and that an annual appropriation has been made, which will enable the Secretary of the Society to devote more time and attention to his annual report. His contribution to this volume will be found replete with interesting and useful information.

The report of the State Entomologist for 1870 is also embraced in this volume. Mr. Riley has devoted more time and labor during the year to the interests of the farmer and fruit-grower, in his special and chosen field of operations, than can readily be appreciated by the uninitiated. The fact that the Secretary and the Entomologist labor in the same office, and that the writer is familiar with, and has cognizance of, many of the experiments made by Mr. Riley, warrant him in the assertion that the reports on entomological topics found in this volume will be full of interesting matter with which every farmer and fruit-grower should be familiar in order to achieve the best practical results to them as a class, and to the State at large.

All of which is respectfully submitted, by

CHAS. W. MURTFELDT,
Corresponding Secretary State Board of Agriculture.

ACKNOWLEDGMENTS.

JOURNALS RECEIVED COMPLIMENTARY AT THE OFFICE OF THE BOARD.

Missouri Democrat, St. Louis.
Prairie Farmer, Chicago, Illinois.
Rural New Yorker, New York City.
Practical Farmer, Philadelphia.
Working Farmer, Baltimore.
American Agriculturist, New York City.
Iowa Homestead, DesMoines, Iowa.
Journal of the New York State Agricultural Society, Albany.
Country Gentleman and Cultivator, Albany, New York.

Exchanged Agricultural Reports with the Agricultural Department, Washington, D. C., and with Secretaries of the Agricultural Societies of the States of Maine, Massachusetts, Connecticut, New York, Ohio, Michigan, Wisconsin, Illinois, Indiana and Iowa.

The members of the Board have received annual passes over the following railroads: Missouri Pacific, South Pacific and North Missouri; and trip passes over the Iron Mountain and Hannibal & St. Joseph.

The Corresponding Secretary has, besides those just named, received courtesies from Alton & Chicago, Vandalia, Illinois Central and Michigan Central railroads, the Alton & St. Louis Packet Company and the St. Louis & Keokuk Packet Companies.

PROCEEDINGS

OF THE

MISSOURI STATE BOARD OF AGRICULTURE.

ROOMS OF BOARD OF AGRICULTURE,
ST. LOUIS, December 7, 1870.

This being the day fixed by statute for the annual meeting of the Board, there were present, Henry T. Mudd, William T. Essex, and N. J. Colman of St. Louis county; William Stark, of Pike county John W. Harris, and O. A. A. Gardner of Boone county; Barnabas Smith of Crawford county, G. W. Kinney of Warren county, and James Moore of Franklin county, of incorporated members. Absent, W. S. Dyer of Jefferson county, George Husmann of Montgomery county; and O. H. P. Lear of Marion county, incorporate members, and Governor J. W. McClurg and T. A. Parker, *ex-officio* members.

From the county agricultural associations as *ex-officio* members there were present, G. C. Swallow of Boone county, W. C. Rickey of Callaway county, Frank M. Dixon of Moniteau county, Green C. Berry of Cole county, and E. W. Bishop of Phelps county. J. J Squires of the Jefferson County Farmers' Club, was present.

Mr. Colman said he was sorry that Mr. Squires did not come within the provisions of the law, which confined the *ex-officio* members to delegates from the County Agricultural Associations.

Mr. Smith: While the law excluded Mr. Squires from being a voting delegate, yet he hoped he would be invited to a seat and assist in our deliberations. We wanted all the light we could get, and to extend our influence as widely as possible we must bring ourselves into closer relations with the people.

On motion of Mr. Kinney,

Resolved, That all representatives from Horticultural Societies and Farmers' Clubs be invited to participate in our deliberations.

Mr. Mudd, President, said now was a very good opportunity to correct erroneous impressions that would be made by leaving uncorrected some remarks reported to have been made by Mr. Muir at St. Joseph, at the late annual meeting of the State Horticultural Society. He had hoped that Mr. Muir would be present to say whether he was correctly reported; and if so, to hear what are the facts in the case.

Mr. Mudd then read from the proceedings, as reported in the St. Joseph *Herald*, in which Mr. Muir is made to say in effect, that though the State Board of Agriculture owed its existence to the State and local horticultural societies, yet it took the first opportunity after organization to treat with contumely and indignity those societies. In the original act of incorporation, the presidents of the State and local horticultural societies were made *ex-officio* members of the State Board of Agriculture. By the action and influence of the board the act of incorporation was so amended as to cut off the horticultural societies, etc.

Mr. Mudd continued. Now while it was true that the act of incorporation had been so changed as to exclude representation from the horticultural societies, it was not true that it was done by the action or influence of the Board; but was in direct opposition to the action of the Board, as the record proves. He then read from the record, showing that when a resolution for such an amendment of the incorporating act was proposed, the Board voted it down with but one dissenting voice. True, the member who proposed it, went to Jefferson City and had the act amended, but it was not done at the instance or procurement of the Board, but against the knowledge and wishes of the other members.

Mr. O. H. P. Lear of Marion county, appeared.

On motion of Mr. Kinney, a committee consisting of G. W. Kinney, N. J. Colman, and J. W. Harris, were appointed by the president to prepare an order of business for the session.

The president stated, according to notices given in the newspapers, certain essays were to be read before this meeting, and the one designated for this forenoon was by Mr. Coleman, on a stock law; asked Mr. Colman if he was ready.

Mr. Colman said that he had, some weeks ago, written an elaborate paper, but had put it by for a review. When on last Monday evening he looked for his manuscripts in order to put on the finishing touches, they were *non est*. He had come to the conclusion that the maid, not understanding the value of these things, had used them for kindling the fire. He had not had time to prepare another paper, but had given the matter so much thought and attention while in the Legislature and recently, that when the Board were ready he would open the discussions by an address.

The matter was then passed over and Mr. Murtfeldt, the Corresponding Secretary, upon leave, read the following paper:

MODEL FARMS—OBJECT LESSONS.

There are obviously two modes of teaching adapted to the human mind, viz: By precept and by example, or, in other words, object lesson. Both have been employed very early in the history of our race. The first method appeals to the intellect and reason by argument; the second appeals through the sense—especially the eye—to the intellect.

When Moses was directed to build the tabernacle, he was not only told minutely how to do it, but he was also shown a pattern—"And thou shall rear up the tabernacle according to the fashion thereof, which was showed thee in the Mount."

In matters agricultural the farmer expects and generally finds "line upon line and precept upon precept" in his agricultural journals, most of which are now being published every week and are well calculated to keep up with the seasons and the times. As a class, agricultural newspapers more nearly and better fulfill their mission than any other class of periodicals devoted to a special interest.

With the deeper interest fostered and stimulated by the agricultural press, agricultural fairs have sprung up—these complete what was left behind, giving the object lesson and appealing through the eye and taste to the mind and the reason.

In our best schools and colleges object lessons are now generally given. The State of Missouri, whose greatest and most vital interests are agriculture and the mines, has concluded to open her university to schools in these departments. Attached to our agricultural college we expect to see a model farm, a specimen orchard, a complete dairy, stables filled with the best types of all our domestic animals, nursery, green and hot-houses, &c., where object lessons can and will be given, and also a school of mines in the mines of the State.

It has generally been conceded that this honorable Board has acted wisely in the ordering of field trials of both soil-stirring and seeding implements and harvesting machinery — in other words has given object lessons, it is to be hoped with good practical results. Its annual report should give the argumentative part of instruction. In these trials we have seen and heard how hard men will labor and how much and eloquently they can talk and set forth the merits of their respective machines; but after all this you say, virtually, "set your machine to work and we can very soon see whether it is as excellent an implement as you describe." Five or ten minutes will often suffice to confirm the claims or upset the finest spun theories and arguments of the inventor or his representatives.

But the force of example or of an object lesson is, perhaps, more apparent, more eloquent, when exhibited in the management of the every day affairs of the farm, the orchard or the garden. Look, if you please, at that farm on yonder eastern slope. The rosy gold of the morning is just tipping the tops of the tallest elms and maples on the smoothly shorn lawn; notice its well kept fences with posts all in line, and gates hung by the level and the square; its well graded roads and drives; its neatly trimmed hedges; its well ordered, convenient and cleanly painted dwelling and outhouses, in close proximity to which is the well kept kitchen garden and the tidy orchard, both indices of good and wholesome cheer. See how evenly those meadows have been mown; notice the straight corn rows — every hill in its place. Over the hill yonder you can just see the deep brown furrows, where but recently the golden sheaves and cones were formed in rectangular rows convenient for the housing. Beyond these are the fragrant pastures, redolent of clover blossoms, separate and yet adjacent to each other, one of them reaching clear up to the barn, whose well-filled mows seem bursting out with new and fragant hay. But look again. In the babbling brook and beneath the shady elm, you observe those broad-backed, deep uddered, "milky mothers of the herd" without which no rural picture seems complete. Such a picture "is a thing of beauty and a joy forever."

But I may no longer dwell upon all the appointments and minutiæ of a well-ordered and well-stocked Western farm, nor yet speak of horses, sheep, swine or poultry, all of which are necessary to a complete object lesson as seen in the model farm, which I have so imperfectly portrayed. Allow me to ask, what is such a lesson worth to its vicinity? Or to the State? Or to every beholder? How eloquent its teachings, arguments and demonstrations! What ought the State Board of Agriculture to do to multiply the numbers of such farms? What can it do to stimulate the owners of our rich prairies, beautiful groves and fertile lowlands to vie with each other in the construction and cultivation of model farms?

If I have not over-rated the logic of my argument, it must be obvious that the verdict of a jury or awarding committee appointed from and by this Board is esteemed of great value by manufacturers, and has been exemplified in the recent field trials held under its auspices. Assurances are not wanting that whenever another opportunity is given competition will be even larger. Will it be less so when the practical farmers are the competitors for awards so highly esteemed? Suppose we have but three farmers in each county who shall strive to have their own the "model farm" in the State; then we have nearly or quite three hundred and fifty farms, every one of which would be an object lesson for each neighborhood. But, says the objector, you do not flatter yourself that you can induce any such number to contest a premium offered for a model farm? Suppose only one hundred, or even ten enter the list, who can fully estimate the value of ten object lessons such as these farms would present to the State of Missouri. Besides, there are natural divisions in farming and men should be allowed to compete in their specialty; we would then have models in stock, grain, dairy and fruit farms, competing respectively with each other, while in prairie counties the planting and cultivation of an artificial grove of valuable timber would still form another subdivision. In pressing the force of example, there is no good reason why a premium should not be offered for the best cultivated and most tastefully adorned village lot or rural residence also.

The most successful of State and county agricultural societies have for years appointed visiting committees upon the plan above indicated, and their reports form a very valuable feature in the annual reports of the transactions of these associations. To keep pace with the march of improvement everywhere discernable throughout the State of Missouri, and not to fall behind our sister States, many of which are much younger in the confederation and less favored in natural advantages, let the State Board of Agriculture appreciate the high trust committed to their keeping and use every laudable effort to place Missouri where she rightfully belongs, in the front rank of this glorious Union of States.

Mr. Colman criticised the paper as more poetical than practical. The secretary had drawn a vivid and most admirable fancy picture not only of an agricultural college farm, but of a well appointed private farm. It looks all very well viewed in the rose colored tints it is drawn, but how will it work when the attempt is made to realize it? A most miserable failure would be the result. To show its impracticability he would instance that of establishing a dairy. He wanted to know who would do the milking? Would the college boys? If so he thought the pail would go up and the milk down. To depend upon hired help would not do. If the professor of agriculture wished to demonstrate any problem in dairying he should take the boys to a well kept dairy or to the blacksmith's shop, if horseshoeing was the point, or to a stock farm if trotting horses were up. He likewise objected to the college undertaking general farming.

Mr. Murtfeldt, replied, that if every thing was to be done in a day, such projects no doubt would be visionary. But every thing is the growth of time, and every thing comes in its time, when wanted, and not before. So it was with a dairy, or any other essential appendage to a farm. He had no faith in men who do every thing according to routine, who drive their carts only in the old ruts made by their grandfathers. Such men never accomplish a new achievement. But men who strive to elevate their profession, must be men whose thoughts rise above the actual to the ideal. They must strive for the unattained, and perhaps unattainable, and their achievements will be great in proportion as their aims are high. He did not expect a dairy at the college farm either to-day or to-morrow, but he hoped to see an organization looking for such and other neccessary appendage in the future.

On motion, the meeting then adjourned to meet at 2 o'clock P. M.

AFTERNOON SESSION.

Present as before, with the addition of Dr. W. S. Dyer, of Jefferson county, and George Husmann, of Montgomery county.

Mr. Murtfeldt read a telegram from T. A. Parker, Superintendent of Public Schools, inquiring if the session would extend to Friday or Saturday; in that case he and the Governor could attend.

Mr. Colman moved that the Board adjourn on Friday evening.

After consultation, the members thought it inexpedient to tie down the Board to any definite time for adjournment, and informally requested Mr. Murtfeldt to telegraph the Governor that the Board probably would not adjourn before Friday evening.

Mr. Kinney made the following report, which was accepted and adopted.

The committee appointed to report the order of business, beg leave to submit the following report:

First. Unfinished business.

Second. New business, such as resolutions, essays, or anything any person present may deem of importance to the interests of the farmer, which business may be disposed of or referred to committees for report.

Third. Stock Law—N. J. Colman.

Fourth. Dog Law—G. W. Kinney.

Fifth. What do the people of the State expect the State Board of Agriculture to accomplish with their present means?—T. R. Allen.

Sixth. The course of study in the Agricultural College—Prof. G. C. Swallow.

Seventh. The Transportation Question—D. G. Jones.

Eighth. The National School of Mines—W. S. Dyer.

Ninth. Practical Entomology—Prof. Riley.

Tenth. Unfinished Business.

Eleventh. Election of new members.

Mr. Tice, Recording Secretary, made the following report of the transactions of the Executive Committee, during the year just closed:

St. Louis, December 7, 1870.

To Hon. Henry T. Mudd, President Missouri State Board of Agriculture:

In conformity to the by-laws, I hereby report a transcript of the record of the Executive Committee, during the year just closed, showing what accounts were audited and what warrants were issued upon the Treasurer for the payment of the same:

Date.	Accounts audited and warrants issued.	Amount.
Dec. 1, 1869	Audited account of J. H. Tice, for salary	$6 25
	“ N. J. Colman, rent	75 00
2.....	“ O. A. A. Gardner, expenses	11 00
	“ J. W. Harris, “	11 00
	“ O. H. P. Lear, “	12 50
	“ B. Smith, “	15 00
	“ Wm. Stark, “	10 00
	“ W. S. Dyer, “	10 00
	“ E. W. Snoddy, “	9 00
31......	“ J. H. Tice, salary	6 25
	“ Missouri Glass Works, phials	5 60
Jan'y 1, 1870	C. W. Murtfeldt, salary	233 33
	C. V. Riley, salary	208 40
31......	C. V. Riley, salary	208 40
	C. W. Murtfeldt, salary and expenses	170 87
February 1......	J. H. Tice, salary and expenses	16 00
March 1......	C. V. Riley, salary	208 40
8......	N. J. Colman, rent	75 00
26......	C. W. Murtfeldt, salary and expenses	281 28
	C. V. Riley, salary	208 40
April 1......	J. H. Tice, salary	12 50
26......	Audited account of C. V. Riley, salary	208 40
May 2......	“ J. H. Tice, salary	6 25
	“ C. W. Murtfeldt, salary and expenses	139 12
21......	“ N. J. Colman, rent	75 00
25......	“ C. V. Riley, salary	208 40
31......	“ J. H. Tice, salary	6 25
June 27......	“ C. V. Riley, salary	208 40
	“ C. W. Murtfeldt, salary and expenses	249 58
July 2......	“ J. H. Tice, salary	6 25
27......	“ C. V. Riley, salary	208 40
August 4......	“ C. W. Murtfeldt, salary and expenses	130 61
Sept. 5......	“ “ “ “ “	128 56
	“ J. H. Tice	12 50
28......	C. V. Riley	416 80
	Expenses for office furniture	241 18
30......	C. W. Murtfeldt, salary and expenses	121 66
October 8......	J. H. Tice, salary	6 25
15......	W. A. Doyle, shelving	31 00
26......	Insurance Exchange, rent	21 33
	Insurance Exchange, rent	41 67
	C. V. Riley, salary	208 40
28......	C. W. Murtfeldt, salary and expenses	123 66
Nov. 4......	J. H. Tice, salary	6 25
22......	Insurance Exchange, rent and gas	42 56
	C. V. Riley, salary	208 40
Dec. 3......	J. H. Tice, salary	6 25
6......	C. W. Murtfeldt, salary and expenses	131 56
	Total amount of warrants	$4,988 87

Wm. T. Essex, Treasurer, submitted his annual report, as follows:

Wm. T. Essex, Treasurer, in account with State Board of Agriculture.

Dec. 2, 1869...	To balance on hand	$2,230 58
April 20, 1870.	To cash from State	5,100 00
	Total	$7,330 58
	CONTRA, Cr.	
Dec. 7, 1870...	By amount of warrants paid	$4,988 87
	By balance on hand	2,341 71
	Total	$7,330 58
	To balance brought down	2,341 71

ESTIMATES:

Our office expenses and traveling expenses of members, amounts, during the year just closed, to about $900 00. It will therefore require to the 20th of April, when we usually receive State appropriation, as follows:	
For C. W. Murtfeldt, salary	$583 34
For C. V. Riley, salary	1,042 00
For J. H. Tice, salary	31 25
For office rent	208 34
For office expenses	50 00
For estimated expenses of members	250 00
Total	$2,164 93
Leaving a balance, April 20	176 78

Respectfully submitted,

W. T. ESSEX, *Treasurer.*

On motion of Mr. Kinney, the same was referred to a committee for examination.

The President appointed Messrs. Kinney and Gardner.

Mr. Colman said, at the last annual meeting he gave notice that he would move at the next annual meeting either to abolish the office of Recording Secretary, or to unite it with that of the Corresponding Secretary.

Mr. Colman then made the following motion, which was adopted:

Resolved, That this Board will have but one Secretary in the future.

Mr. Essex offered a resolution to fix the salary of the Secretary at $2,000 per annum.

Mr. Gardner offered an amendment to strike out $2,000 and insert $1,600. He stated that he offered the amendment simply to bring our expenses within our means.

An examination of the receipts and expenditures showed that unless our appropriation was increased, we could not pay the Secretary $2,000 a year without creating a deficit.

On motion of Mr. Stark, the resolution and amendments were referred to the New Board.

Mr. Kinney offered the following resolutions:

Resolved, That the President of this Board be authorized to appoint each member of this Board a delegate to visit a certain number of fairs, not less than three each year, and that each delegate be required to note the general management thereof, the amount of stock, agricultural products, machinery, implements, etc., on exhibition, and such other facts and suggestions as he may think worthy of recommendation or condemnation, and to report the same at the next annual meeting of the Board.

Resolved, That in making such appointments, the President shall do so with reference to the convenience of members, but no member shall be a delegate of his own county fair.

Col. Colman could not see the force of the resolution. He thought the proposition was very plausible, but could not be practicable or achieve the desired results.

Mr. Harris thought some arrangement could be made by which reports could be obtained without sending delegates to the fairs.

Mr. Gardner thought it would wake up some interest. The country fairs would try to have things in good order so as to have honorable mention made of them.

Mr. Porter thought the Secretary might have more than he could do if he had to receive reports from each member of three fairs; but considered that the spirit of the resolution was a laudable one.

Mr. Colman was of opinion that the expense entailed would not be commensurate to the benefit derived. One fair was about a repetition of the other. He thought if the members of the Board were required to furnish such a report or resign, that there would be a great many more resignations than reports. Besides, every paper has a full report of every premium awarded in the State.

Mr. Kinney said he did not, when he offered the resolutions, contemplate publishing all the reports, but to furnish them to the Secretary and let him cull whatever he thought would be useful and interesting.

Mr. Mudd, the President, thought if the fairs were reported it would have a very beneficial result. If they find they are going to be reported, they will take care to have things as orderly as possible. He thought the scandalous games which were at present tolerated in fairs would be done away with.

Mr. Colman said if the Board were to become missionaries, and censors of the people, he could not think of a better person to do such work than Mr. Mudd. But is the State Board of Agriculture to become the censors of the people and tell them what is moral and immoral? The Board was not necessarily moral reformers. He did not consider it their duty to be teachers in this respect. It is the agricultural interests that the Board should look after; not betting, or playing chuckaluck. All the Board combined could not stop betting. The last speaker and himself had had little bets on elections, and the last speaker wore his hundred dollar suit all winter. The country people would not care to have men come to their fairs, and report their shortcomings. He saw nothing wrong in the resolution, but it could be carried to a dangerous extent. If the resolution were passed he should, of course, do his work. But after the reports were sent in, they would not, he considered, be worth the paper they were written on.

Professor Swallow moved to strike out the word "three," and insert the word "one," so as to read "one fair."

Mr. Kinney accepted the amendment, and the resolution as amended was adopted.

Mr. Murtfeldt offered the following preamble and resolutions:

WHEREAS, The rapid development of the State of Missouri in all its industrial phases, especially in agriculture and the mechanic arts, demands the formation of a State Agricultural and Mechanical Association, which shall take rank with the best of like institutions; which shall hold annual fairs, offer premiums for model farms, field crops and the cultivation of artificial groves, which shall foster and encourage manufactures and skill in mechanics in a manner common to such associations; and

WHEREAS, While we do not undervalue the high position and enviable reputation enjoyed by the St. Louis Agricultural and Mechanical Association, we nevertheless believe that other parts of the State of Missouri should receive that encouragement which this State Board of Agriculture, at the head of a State Agricultural Society, ought to give; therefore,

Resolved, That we now form a State Agricultural Society.

Resolved, That due notice be given throught the public press by the Corresponding Secretary, that proposals will be received for the holding of a State fair early in the autumn of 1871, such proposals to be in the hands of the Corresponding Secretary by February—, 1871.

Resolved, That a committee of — be appointed by the president to prepare a circular setting forth the requirements of a city or place competing for the first and second annual fairs of the Missouri State Agricultural Society.

Mr. Harris moved that a committee of three be appointed to report upon the resolution. Carried.

Messrs. Harris, Colman and Kinney were appointed by the chair as the committee.

Mr. Kinney, offered the following resolution:

Resolved, That this Board recommend to the Legislature to amend the law under which county agricultural societies are organized, so that they shall be compelled to report to the Secretary of this Board before its annual meeting; and if they fail to do so two years in succession, they shall forfeit their organization,

Mr. Harris moved to refer it to a committee of three, for investigation. So referred.

Messrs. Kinney, Swallow, and Rickey were appointed a committee.

Mr. Gardner, of Boone county, offered to renew the following resolution, which he offered last year, and which the Legislature failed to comply with:

Resolved, That in the opinion of this Board the presiding officers of the Horticultural and Grape-Growers' Societies, and Bee-Keepers' Societies, and regular organized Farmers' Clubs of this State, should be admitted as *ex-officio* members of this Board, the same as the Presidents of Agricultural and Mechanical Societies are now admitted; and we respectfully ask the Legislature to change the law organizing the Board, so as to effect this object. Adopted.

Mr. Kinney offered the following resolution, which was referred to the same committee as the last resolution:

Resolved. That this Board recommend and petition the Legislature of the State, to offer the following premiums, to be awarded by committees appointed by the President of this Board:—

For the best cultivated farm, not less than 500 acres, $100; the best cultivated farm not less than 160 acres, $100; the best cultivated farm, not less than 40 acres, $100; the best market garden, not less than —— acres, $100; the best nursery of fruit and other trees, not less than —— acres, $100; the best half mile of hedge, $50; the best orchard, $50.

Professor Swallow pointed out several eggregious errors in the published report of the Board. One company came to Missouri, he said, on the information there given, spent half a million of dollars in fixing up for a coal mine, and dug out all the coal in about six loads. He wishes to have the report correct if it was published as coming from the Board; otherwise it should go as merely the report of the secretary. Of course, no secretary could be expected to be cognizant, of every scientific statement or facts published by the State Board of Agriculture, and commenced a severe attack on the statements of former reports. He pointed out some errors that appeared in a lecture of geology, and said that a Philadelphia firm had been induced to spend millions of dollars on the representation made there of the amount of cannel coal in the State, and had only been able to get a few boat loads of the coal in return for the expenditure. He also found fault with the statements made respecting the making of oil, and inquired if the reports were understood to go before the public as those of the Board or those of the Secretary.

The President stated that on the face the report showed as being that of the Corresponding Secretary.

Prof. Swallow: That is what I want to known. He, therefore, thought that a Committee of Publication ought to be appointed with authority to revise all reports and papers before publication.

Mr. Murtfeldt said it was not expected that the Secretary could know every thing. The paper complained of was a lecture by Prof. Wilbur, and he had inserted it in the report upon the reputation of the author as a scientific man.

Adjourned till to-morrow morning at 10 o'clock.

THURSDAY MORNING, Dec. 8, 1870.

The Board met pursuant to adjournment.

Present as yesterday.

The President stated that the first thing in order is Col. Colman's address on the stock law.

Mr. Colman stated that as some of the delegates interested in such a law were not present, yet, he would suggest that the matter be laid over informally, which was accordingly done.

Unfinished business being called:

Prof. Swallow said there was a matter of business that was not finished last night; that was, the report of the State Board of Agriculture. He moved that the subject be referred to a committee, who should inquire who was responsible for the reports, and what measures should be taken to have them correct.

The motion was adopted and a committee appointed, consisting of Messrs. Swallow, Smith and Stark.

Mr. Gardner offered the following resolution:

WHEREAS, Our State Entomologist is devoting his entire time to the diffusion of useful knowledge in relation to the insect enemies and foes of our State; *and whereas*, he is required to furnish the engravings used to illustrate his annual reports; *and whereas*, it is desirable that this Board should own electrotype copies of such illustrations; *and whereas*, the act of the last Legislature appropriates the sum of three thousand dollars for the pay of State Entomologist, as solicited by our Treasurer in his last annual report and endorsed by this Board;

Resolved, That the salary of our State Entomologist be $3,000 per annum, commencing with the coming year, and that electrotype copies of all illustrations used in future reports are to be furnished to the Secretary of this Board by the State Entomologist, as soon as the reports are published.

The resolution was discussed at length by Messrs. Gardner, Essex, Swallow, Lear, Dyer, and explanations made by Mr. Riley.

The discussion elicited the following facts:

That Mr. Riley had been put to the cost of obtaining engravings for his report, and these engravings were not consequently the property of the Board. A note was read by Mr. Essex showing that Mr. Riley had spent $1,180, during the last two years, for assistance, illustrations and incidental expenses, outside of, and not including his cabinets, library, and other office furniture. It appeared that Mr. Riley's salary was only $2,500 the present year, though the Board recommended an increase of $500 a year ago, and the Legislature has, for the past two years, appropriated $3,000 for the State Entomologist. Mr. Riley said that he was sorry to have the matter brought up at this time, as it was generally understood that as soon as the Board could afford it the $500 would be paid. At present all the appliances in his office were his private property, as he had paid for them with his own money.

Mr. Gardner said he submitted the resolution because he desired that the Board should possess all the illustrations. He moved that it be referred to a committee of three. Carried.

Messrs. Gardner, Colman and Dr. Dyer were appointed as the committee.

At this stage of the proceedings a very beautiful basket bouquet was presented to the President of the Board with the compliments of the donors, Messrs. Michel Bros. & Kern. It was a model of taste and beauty, and its delicious fragrance filled the rooms for two days.

Prof. Swallow, from the Committee on Annual Reports, made the following report:

Mr. President: Your committee would respectfully report—

Many important errors have already found a place in the reports of this Board. As samples we would mention a few.

In the first report, in both editions, page 174, an entire scientific paper was incorporated without any credit to the author. In an article on the Vine District of Missouri, on page 72 of the report for 1867, it is declared that the rocks under the vineyards of Washington and Hermann, belong to the "upper silurian age," when in fact there are no such rocks there. In the same article it is stated the belt of the true wine lands lies between the altitudes of 400 and 800 feet, and that this position is demonstrated by the growth of wild grapes; and that the vineyards of St. Louis county, of Hermann, and other points in Franklin, Washington and Jefferson counties, except Massey's, are below this belt and therefore of small account; whereas, it is evident these vineyards are at a very good altitude and that wild grapes grow far below this belt, and that many of the most successful vineyards do exist in Missouri, Florida, California and other parts of North America, as well as in the Mediterranean regions of Europe and Asia, and on the shores of the Indian Ocean. In fact the great grape regions of the world are below this altitude.

In the report of 1869, page 220, is is stated that the Chariton coal field is the largest in Missouri, and that this coal field is only 150 miles long and 30 wide, when in fact, this coal field extends from the mouth of the Des Moines to the Indian Territory, and from Audrian county, Missouri, to Manhattan, in Kansas, and to the northwest as far as Omaha. It covers an area of 27,000 square miles in Missouri, 12,000 in Kansas, 6,000 in Nebraska and as much more in Iowa.

It is also stated that the cannel coal beds in Callaway, Boone and Howard, cover an area of 1,500 square miles — but those beds in these counties do not cover 50 square miles.

It is also estimated that wood lands in Missouri will yield 300 cords per acre, and that the wood will yield 100 bushels of charcoal per cord. This is rather high for the forests of the iron region.

These and other errors are a great defect, and they are calculated to mar and render our reports powerless for good at home and abroad.

The order of business was then resumed, which was Col. Colman's address on a law to restrain stock from running at large.

Col. Coleman said the term stock law was rather vague; its meaning was a law to compel owners of stock to keep them from running at large. It had engaged the attention of the people of the State, and been largely discussed at farmers' clubs, agricultural papers and even in political journals. He (the speaker) had the honor to prepare a bill which was submitted to the House of Representatives last winter, and it undoubtedly would have passed if it had been presented at an earlier day; but being offered at the time when a large number of members had left, and then it lacked eight or ten votes of being a success when put upon its passage.

Different views in regard to the law were held by different parties. Some very warm friends of the law were in favor of a general law which should apply at once to the whole State, but such a law could not be passed; the people of the State were not prepared for it; they were not educated up to that point and the members of the Legislature would not dare to vote for such a law. As the State became older and timber, became more scarce, the people would be prepared for such a law. Such a law had passed in Ohio and other States. It met with great opposition at the start, but that finally died away, and those who were formerly the strongest opponents of the law became its warmest friends. When the cattle were allowed to go loose, farmers were compelled to fence their lands at great cost. A man might have a farm of 500 acres and the expense of enclosing that entire farm, preparing a fence and renewing it every eight or ten years would be enormous. Farmers of the State where the law was tried found to their great gratification that it was the most economical measure that was ever adopted.

The provisions of the bill he (the speaker) drafted were, that when fifty freeholders of any county in this State shall petition the county to submit to the people a vote on that question whether they were in favor of the law or against it, it shall be the duty of that county to open polls through the county, that the voice of the people might determine the question, and whenever a majority of the people favored it it should become a law. That was Democratic and Republican.

The speaker went in at length and earnesly advocated the adoption of the bill. He claimed that if such a law was passed emigrants would flock in from every quarter; they would raise their fifty or sixty acres of corn the first season without spending months and years in enclosing their land. He did not think there was any measure before the people of the State that would have a tendency to so fill up the State with an enterprising population or to increase its production at a larger rate.

Dr. Spalding said he was in favor of a law restraining stock running at large just as soon as such a law could be practically enforced and just as soon as the constitutional provisions of our State would admit of the enactment of such a law. He said there was an insuperable objection to the passage of such a bill as had been described by Mr. Colman, and if it was passed, it would be a nullity. He said that our Constitution prohibited anything but general legislation, and it would therefore obstruct laws having a special character or limited effect. He stated that recent decisions of the Supreme Court covered that ground.

Col. Colman did not think the measure was unconstitutional; he believed the statement entirely without foundation. Before preparing the bill he had consulted with the best legal minds in the State, and he was sure the bill was constitutional. He would favor the bill even if it was unconstitutional. He thanked God that the Drake constitution was dead, and on its ashes there would rise one breathing the spirit of freedom.

Mr. Murtfeldt expressed himself in favor of protecting every man's rights, and of legislating for the greatest good of the greatest number. It was not proposed to pull down any fences, or to prevent building new ones; but it was proposed that every man should take such care of his stock as would insure his neighbor against damage, and that, when damage was done, the stock should be held responsible.

Mr. Gardner then introduced the following preamble and resolutions, which had been prepared by the Secretary:

WHEREAS, It is a notorious fact, patent to every observer, that the destruction of field and garden crops, as well as of orchard fruit and ornamental trees, shrubs and flowers, consequent upon the unrestrained running at large of domestic animals, amounts to hundreds of thousands (if not millions) of dollars annually in the State of Missouri alone.

WHEREAS, Such animals are turned out ostensibly to pasture upon the highways and the lands of non-resident owners, but really to get a living at any rate; and,

WHEREAS, These animals, at certain seasons of the year, much prefer to feed upon corn and other growing crops (not always their owner's) to the scanty pastures of the highways, or the frost-bitten wild grass of the sloughs, woods and prairies; and,

WHEREAS, Much contention, bickering, going to law, neighbor with neighbor and brother with brother, fighting and murders, result from the above-mentioned practice; therefore,

Resolved, That we, the members of this Board, will use our best personal and collective efforts to insure the passage of a law by the next or subsequent General Assembly, that shall make it obligatory upon every man to take such care of his domestic animals, to wit: Horses, mules, neat cattle, sheep, swine and goats, as to prevent their pasturing upon lands not his own, whether belonging to resident or non-resident owners, unless such animals are, during the entire time, under the care of competent herdsmen.

Resolved, Second, That the expense necessitated by the enclosure of farms other than is elected by the *bona fide* owners thereof, is onerous, unnecessary and arbitrary and ought to be abolished.

Resolved, Third, That the plea for the poor, so commonly advanced in giving them the privilege to pasture the highways, is a myth and a damage.

Resolved, Fourth, That immigration into our beloved State is greatly hindered, and the face of nature sadly marred by the prevalent custom of fencing as at present practiced.

Col. Colman: I think these resolutions are too stringent; they have been drawn with much care, but I think they should not pass here, because they ask too much. We can catch more flies with molasses than we can with turpentine.

Mr. T. R. Allen: I wish to make a statement here, premising it with the full endorsement of the resolutions. I, Mr. President, while engaged in my own business, upon my own premises, and without provocation or warning, have been shot at—the shot going through the skirts of my coat—because I have driven the hungry and unruly cattle of my near neighbor (?) from off my lands; because of this he has sought my life.

Mr. Bishop: I have had two caps of a revolver snapped at me by a man who lives near my farm, because I set my dog on his hogs, who were destroying my corn; the third cap exploded the charge and killed the dog, and this, too, after I had told him he might help himself out of my crib to corn for his hogs, free of charge; but he insisted that the hogs should help themselves—to accomplish which he would not stop even to kill me.

Dr. Henderson said he was committed to speak in favor of a stock law, although most of the ground upon which arguments could be based, had been traversed. Upon the principle of abstract right, no man had any business to pasture his stock upon his (the speaker's) lands, whether enclosed or unenclosed. If the owner of unenclosed lands did not pasture them, he was still entitled to have the annual crop of grass to enrich the soil by its decay. The trespassing stock should be held responsible. He had kept cattle in his pastures in the hope that their owners would come and claim them, for he wished to see the owner; but, frequently, he had been obliged to turn them out in self-defense, the owner refusing to come to time. No man had a right to keep stock which he was not prepared or able to feed at all times, as much so as his children. He did not believe much in the molasses theory of Col. Colman. Let us ask for what we want, and all we want—and if the Legislature refuses to give it to us, we can put up with less. All our legislators need is to know the will of the people. If the people are not educated up to the standard, the sooner they become so the better.

The subject was further debated by Messrs. Peabody, Smith, Moore, Dyer, Squires, Kinney and Husmann.

Mr. Kinney offered the following resolution:

Resolved, That this Board is in favor of a stock law embodying the principles and provisions of the one drafted by Col. Colman, and which was introduced in the last Legislature.

Mr. Husmann said he saw a serious objection to such a law, since if a county adopted the law, and the adjoining counties did not, serious neighborhood difficulties must arise in consequence.

On motion, the Board then adjourned to 2 o'clock, P. M.

AFTERNOON SESSION.

CONSIDERATION OF STOCK LAW RESUMED.

Judge Wielandy, of Cole county, addressed the Board at length upon the measures relating to the advancement of agriculture, that probably would come before the Legislature at the coming session. He did not know what the feeling and dispositions of the members of the Legislature were; does not wish to be understood as speaking for the Legislature, but only as giving his individual opinion. He had, however, no doubt that in the future the Legislature would be as liberal as in the past; and would increase its liberality in proportion as public sentiment became enlightened. He did not share in the opinion that had been expressed by some, that the Legislature had been parsimonious in its appropriations because it did not appreciate the importance of agriculture. The truth is, instead of lagging behind, the Legislature had gone in advance of popular sentiment in its appropriations and legislation. The true way of operating upon the Legislature is to operate upon the people, and create a public sentiment that will sanction liberal appropriations and enlightened legislation. The best thing the Board could do was to do something worthy of liberal appropriations, that had a practical bearing on agriculture, by disseminating a knowledge of the progress made elsewhere in agriculture, and making the people acquainted with the improvement in stock, utensils and machinery. Besides this to create an enlightened public sentiment as to what legislation is necessary for the protection of agricultural interest. Some such subjects he was glad to see now engaged the attention of the Board. One of which was a judicious stock law, the subject now under debate. The importance of such a law he fully appreciated, and foresaw the advantages that would accrue to the farmers upon such an enactment. While he entirely concurred in sentiment with the advantages of such a law, he could not, however, close his eyes to the fact that there were difficulties in the way. While he thought that the draft prepared by Col. Colman presented the subject in the most practical way, yet with the constitutional provisions providing for plenary powers of legislation in the General Assembly, but only upon general laws, and with the recent decisions of the Supreme Court, he saw there were constitutional difficulties in the way. But the greater difficulties would be found in adjusting the details, so as to make it practical, efficient and harmonious.

He could, therefore, not be expected to pledge himself to any particular form of stock law at present. But when the time came for action, he might be relied on in sustaining the most practicable means.

The resolution was then adopted.

Mr. Kinney submitted the following resolution, which was adopted:

Resolved, That this Board invites and requests the Hon. N. J. Colman to address the members of the Legislature at the ensuing session upon such matters relating to the agricultural interests of the State as may require legislative action in order to promote the interests of the farmers of the State, and especially in advocating a stock law, a dog law and such other legislation as the Board will recommend.

Mr. Colman asked that the privilege of making a personal explanation be accorded to Mr. Muir, which was granted.

Mr. Muir then stated that his remarks at St. Joseph, which had been criticised, were misrepresented and misreported in the papers.

Mr. Kinney then read the following essay on a dog law:

[Essay found in annual report.]

The essay was discussed by Messrs. Lear, Smith, Mudd, Moore, Porter, Colman, Henderson, Dyer, Squires and Clagett.

Mr. Lear submitted the following resolution:

Resolved, That the President appoint a committee of three, whose duty it shall be to draft a dog law to be laid before the Legislature for action.

Mr. Gardner offered to amend the resolution, by prefixing the following preamble as an amendment:

WHEREAS, The essay read by Mr. Kinney expresses the sentiments of this Board; therefore, etc.

Mr. Lear accepted the amendment.

The preamble and resolution were then adopted.

Mr. Lear having declined to serve on the committee, the President appointed Messrs. Kinney, Gardner and Smith said committee.

The Board then adjourned to 9½ A. M. to-morrow.

FRIDAY MORNING.

The Board met pursuant to adjournment. Present, same as yesterday.

Mr. Gardner, from the Committee on Salary of Entomologist submitted the following report:

The committee, to whom the resolution in regard to the salary of the State Entomologist was referred, would report that they have examined the same and recommend that the resolution, as originally read, be adopted.

O. A. A. GARDNER,
N. J. COLMAN.

Mr. Colman was in favor of the adoption of the report, and said that the illustrations in the reports of the State Entomologist were the most important part of it; without them his reports were worthless. There must be something to speak to the eye; something by which the farmer could know what insects to destroy and what to save; otherwise he might kill his friends and save his enemies. Object lessons were more needed in Entomology than in any other science. He should vote for the adoption of the report as a matter of justice to the State Entomologist, and to the people at large. He was sure that Mr. Riley would use the $500 to the best advantage in procuring electrotype plates.

President Mudd offered a substitute to the report:

Resolved, That the salary of the State Entomologist be $3,000, from the first of January next.

He was willing to vote this sum without any proviso; if they wanted to appropriate a separate sum for illustrations he would vote for it, but he did not believe in uniting the two things in one.

Col. Colman could not see the propriety of adopting such a report as that proposed by Mr. Mudd, when Mr. Riley offered to supply the illustrations for the additional $500. The extra compensation was given for the express purpose of getting up these illustrations, and the Board should certainly have the benefit of it.

Mr. Mudd said the Board might just as well give Mr. Riley $2,500, because they offer to give him $3,000, but make a proviso that $500 shall be expended in illustrations. Let his salary be fixed at a certain sum, (and he was willing it should be $3,000) and then appropriate a certain sum for illustrations. It was not a business like way of doing things to give a man a fixed salary, and then say that he shall expend a certain sum out of such salary.

He proposed as a substitute for the report the following resolution:

Resolved, That $500 be paid to C. V. Riley, State Entomologist, for the purpose of procuring illustrations for his reports.

Col. Colman offered to amend the last resolution by adding "and that he be required to furnish electrotype copies of all cuts published in his reports, which shall be furnished to the Secretary of this Board; and become the property of the Board."

Mr. Mudd accepted the amendment, and the resolution as amended was adopted.

Prof. Swallow, from the Committee on Errors in Annual Reports, made the following additional report:

Art. 12. The president of the Board shall appoint a committee of two, whose duty it shall be, in connection with the secretary, to examine the reports before they are published, and that this committee shall have power to correct all important errors they may find. The president shall be *ex officio* chairman of this committee.

G. C. SWALLOW,
B. SMITH,
WM. STARK.

Mr. Mudd, President, called the attention of Prof. Swallow to the fact that the by-laws could not be amended unless two weeks' notice had been given to all the incorporate members of such intention to amend; and asked Prof. Swallow whether such notice had been given.

Prof. Swallow replied there had not been.

Mr. President: Then the matter is out of order until the proper notice is given.

Prof. Swallow said as there was no present remedy, he would offer the following resolution as a temporary measure:

Resolved, That the President be required to appoint a committee of two, whose duty it shall be, in connection with the Secretary, to examine the report before the same shall be published, and that this committee shall have power to correct all errors observed. The President shall be *ex-officio* chairman of this committee.

The resolution, as submitted, was adopted.

Mr. Smith stated as some of the members and delegates had to leave by the afternoon trains, he would move that the Board now proceed to fill vacancies occurring by expiration of time of service.

The motion, after some discussion, prevailed.

The President called upon the Recording Secretary for a list of the vacancies and the names of the members whose time of service had expired.

Mr. Tice, Recording Secretary, read from the records of the annual meeting held on December 5th, 1867, from which it appeared that the following members were elected at that time, namely: J. W. Harris, O. A. A. Gardner, W. T. Essex, and N. J. Colman. Consequently their term of service, three years, expires with the present session.

A ballot was then had to fill the vacancy occasioned by the expiration of the term of service by O. A. A. Gardner, which resulted as follows: Judge J. F. Wielandy, 9 votes; O. A. A. Gardner, 3 votes. Judge Wielandy was declared elected.

A ballot for the vacancy of J. W. Harris resulted as follows: J. W. Harris, 7 votes; Col. Northcote, 5 votes; Mr. Robinson, 1 vote. Mr. Harris was declared elected.

The ballot to fill the vacancy of Mr. Essex resulted as follows: W. T. Essex, 8 votes; Col. Northcote, 5 votes. Mr. Essex was declared duly elected.

The ballot to fill the vacancy of Mr. Colman resulted as follows: N. J. Colman, 11 votes; Dr. Spalding, 1 vote.

On motion of Mr. Smith, the annual meeting then adjourned *sine die*.

JOHN H. TICE,
Recording Secretary.

NEW BOARD.

December 9, 1870.

Pursuant to a notification of the President, the Missouri State Board of Agriculture met for organization.

Present—Henry T. Mudd, Wm. T. Essex and N. J. Colman, of St. Louis county; Dr. W. S. Dyer, of Jefferson county; Wm. Stark, of Pike county; O. H. P. Lear, of Marion county; George W. Kinney, of Warren county; Judge James Moore, of Franklin county; Barnabas Smith, of Crawford county, and Judge John F. Wielandy, of Cole county.

Absent—George Husmann, of Montgomery county.

The Board was temporarily organized by appointing N. J. Colman Chairman.

The Chairman stated the first business in order was the election of President for the ensuing year.

Messrs. Mudd and Harris were nominated.

Mr. Harris positively declined.

A ballot was had, which resulted as follows:

Henry T. Mudd	10 votes.
J. W. Harris	1 vote.

Whereupon Henry T. Mudd was declared elected President for the ensuing year.

The next business in order was the election of Vice President.

J. W. Harris was nominated.

A ballot was had, and J. W. Harris having received all the votes cast, he was declared elected Vice President for the ensuing year.

The next business in order was the election of Corresponding Secretary.

Mr. C. W. Murtfeldt and Wm. Porter were put in nomination.

A ballot was had which resulted as follows:

C. W. Murtfeldt	9 votes.
Wm. Porter	2 votes.

Mr. Murtfeldt having received the majority of votes cast, was declared duly elected Corresponding Secretary for the ensuing year.

The next ballot was for Treasurer, and Wm. T. Essex receiving all the votes cast, was declared duly elected Treasurer for the ensuing year.

Mr. Mudd, the President elect, upon taking the chair, made the following remarks:

Gentlemen of the Board:

Whether my opinion coincides with yours in the choice of your presiding officer; whether I agree with you that you have made the best choice or not, I cannot fail to appreciate the partiality which you have shown toward myself, and if anything was necessary to stimulate me to renewed exertions; if my devotion to agriculture needed stimulus, I think I ought to find some in the continued confidence which you have expressed in selecting me again to preside over this society for the ensuing year.

I cannot promise you a great deal more than I have done in the past, but I will try to do better. I can only promise that the best exertions I can make toward the improvement for which you are laboring, shall be at the disposal of this Board. I undertook to discharge the duties of this office, last year, with a great deal of diffidence, and without confidence that I could give satisfaction to you and the people of the State. My efforts, it seems to me, have been more than appreciated; and in return, I shall certainly try not to do any worse in the future than I have done in the past. If I make any change, I will endeavor to make it for the better. I thank you for the partiality you have shown towards me, and for the confidence you have reposed in me.

The Board then adjourned to half-past 1 o'clock P. M.

AFTERNOON SESSION.

FRIDAY, December 9, 1870.

The Board met pursuant to adjournment.

Present—Messrs. Essex, Lear, Smith, Colman, Moore, Kinney, Wielandy, and Mudd, President.

A pamphlet on "Earth Closets," was presented for distribution among the members.

Mr. Colman said that suggested a fact of importance to farmers, namely, the organization of a company here to manufacture Bromo phyte from night soil. He presented a sample of the article for examination.

Mr. Porter gave an explanation of the manufacture of Bromophyte, which in the Greek meant plant-food, as he had seen it last summer at Chicago. As a deodorizer and absorbent peat was used there. As there was no peat here he presumed that clay, which answered the same purpose, would be used. The only difference would be that the Chicago article would be more concentrated and less bulky.

Mr. Smith offered the following resolutions, which were adopted:

Resolved, That this Board would respectfully ask of the General Assembly to so amend the law as to make the Professor of Agriculture in the University of Missouri and the Superintendent of the Agricultural Farm connected with that institution, *ex-officio* members of the State Board of Agriculture.

Resolved, That this Board invites and requests the Hon. N. J. Colman, to address the members of the Legislature at the ensuing session, upon such matters relating to the agricultural interests of the State, as may require legislative action, in order to promote the interests of the farmers of the State, and especially in advocating the stock law, the dog law, and such other legislation as this Board shall recommend.

O. H. P. Lear offered the following resolution:

Resolved, That this Board memorialize the Legislature to pass a law organizing a district fair in each Congressional district in the State, and appropriate the sum of —— dollars, to be paid as premiums for the best cultivated farm, the best orchard and the best hedge in each district.

Referred to the committee to which was referred the establishment of State fairs.

Messrs. Stark and Dyer appeared in their seats.

Mr. T. R. Allen then read an essay on "what do the people expect the Board to accomplish with their present means?" which will be found amongst essays in this volume.

The essay was discussed by Judge Wielandy, Porter, Colman and Dyer.

On motion of Mr. Smith, it was

Resolved, That the further reading of essays be dispensed with, for lack of time, but published in report.

Mr. Harris offered the following resolutions, which were adopted:

Resolved, That the thanks of this Board are hereby tendered to the officers of the railroad companies that have favored the members of this Board with passes over their roads; and that we hope the results of our labors will greatly increase their business.

Resolved, That all business requiring legislative action shall be referred to a committee of five, and that they be instructed to visit Jefferson City this winter and urge the passage of such laws as may be deemed necessary and proper.

Messrs. Harris, Kinney, Colman, Smith and Moore were appointed said committee.

On motion of Mr. Smith, it was

Resolved, That the Secretary be appointed a committee to return the thanks of this Board for the favors extended by the railroad companies of our State. and to solicit the continuation of the courtesies heretofore extended to the members and officers of the Board.

On motion of Mr. Harris, it was

Resolved, That a committee of two be appointed to solicit from Professor Swallow and others who had prepared essays, copies of the same for publication.

Messrs. Harris and Colman were appointed.

On motion, the President was added to the committee.

Mr. Kinney made the following report, which was adopted:

The committee to whom was referred the resolution in relation to State and district fairs, have had the same under consideration and would most respectfully report against their adoption; but they recommend that the following be adopted as a substitute for the resolution on premiums, also referred to them:

Resolved, That the Board recommend a petition to the Legislature of the State, to offer the following premiums, to be awarded by a committee to be appointed by the President of this Board:

For the best conducted farm, not less than 300 acres, one hundred dollars.

For the best conducted farm, not less than 160 acres, one hundred dollars.

For the best conducted farm, not less than 40 acres, one hundred dollars.

For the best nursery of fruit and other trees, not less than 30 acres, one hundred dollars.

For the best mile of hedge, fifty dollars.

For the best orchard, two or more acres, fifty dollars.

For the best five acres of wheat, fifty dollars.

For the best five acres of corn, fifty dollars.

For the best five acres of oats, fifty dollars.

Resolved, That any person competing for any of the above premiums, shall furnish a detailed statement of the management, expenses, receipts and profits thereof.

G. W. KINNEY,
J. W. HARRIS,
N. J. COLMAN.

On motion, the Board then adjourned *sine die*.

JOHN H. TICE, *Recording Secretary*.

SESSION AT JEFFERSON CITY.

The State Board of Agriculture met at Jefferson City, January 24th, 1871, pursuant to a call of the President.

Hon. Henry T. Mudd, President, in the chair.

C. W. Murtfeldt, acting Secretary.

Present—Messrs. Henry T. Mudd, Wm. T. Essex, Norman J. Colman, St. Louis; Barnabas Smith, Crawford; Geo. Husmann, Montgomery; Jas. Moore, Franklin; J. W. Harris, Boone; G. W. Kinney, Warren; J. F. Wielandy, Cole.

Absent—Messrs. O. H. P. Lear, Marion; Wm. Stark, Pike; Dr. W. S. Dyer, Jefferson; Gov. B. Gratz Brown, Hon. Ira Divoll, State Superintendent Public Schools.

On motion of Judge Wielandy, the reading of the minutes of the last meeting was dispensed with. Col. Colman and Judge Wielandy made remarks to the end that a careful review be had by all the members of the Board, of such measures as, in the opinion of the Board, require legislation; such as the stock law, the dog law, the prevention of the spreading of the noxious weeds, etc.

Judge Wielandy suggested that it would be very difficult, if not impossible, to pass a bill that was not first favorably reported upon by the appropriate committee of either House or Senate, and farther that the Board confine themselves to the recommendation of such measures as are strictly agricultural.

On motion, Judge Wielandy was added to the committee to memorialize the Legislature upon measures of interest to the farmers, appointed at the annual meeting.

Mr. J. W. Harris, chairman of said committee, wanted the members to settle down to work, and with this in view, divided the various topics to the respective members of committee.

Hon. Ira Divoll, through Col. Colman, tendered the room of the State Superintendent of Public Schools for the use of the Board during the present meetings.

Judge Krekel, through Mr. Husmann, likewise tendered the use of his court room to the Board, for same purpose.

On motion of Col. Colman, President Mudd was appointed a committee to select the room.

Permission was given, and President Arthur Barrett, of the St. Louis Agricultural and Mechanical Association, was invited to explain some measures in contemplation in regard to the building of a suitable hall on the fair grounds of said association, for the purpose of holding discussions upon leading agricultural interests, during the fair of said association; because at that time many distinguished gentlemen, either officers of the State Agricultural Societies or eminent agriculturists, would be in attendance, a detailed account of whose experience and experiments would be of value if embodied in the State Agricultural Reports.

Mr. Barrett further requested that the members of the State Board of Agriculture recommend the printing of 500 copies additional Agricultural Report, including full report of St. Louis Fair, for the use of the St. Louis Agricultural and Mechanical Association.

Mr. Barrett further explained the hardships of the workings of the present license law, requiring the payment of $50.50 per each license, being for the term of six months, for the privilege of selling refreshments at the fair grounds during the fair week or for only six days.

President Mudd remarked that, as president of the board of assessors, he was somewhat familiar with the revenue laws, and thought it clearly within the province of the Board to ask the General Assembly to enact a law that should exempt from taxation all grounds used for agricultural fairs only.

President Mudd further referred to the discussions usually held on the fair grounds of the Illinois State Agricultural Society, as one of the most interesting and instructive features of the fairs of that society.

Mr. Harris expressed himself much gratified at the remarks of President Barrett, and urged the hearty co-operation of the Board.

Col. Colman would be glad, indeed, to have a suitable hall on the fair grounds for the purpose stated; it would no doubt be productive of much good. It ought to be in the second story of some building, where the attention of the audience would not be diverted by other features of the fair. But at nightfall the St. Louis fair grounds were generally deserted; it was not as at the Illinois State fairs, where people came with their own teams and wagons, and remained on or near the grounds all the week; but the State would not be likely to erect such a building, as it had hitherto hardly provided for the payment of a sufficient salary for the officers of the State Board of Agriculture. If private subscriptions were called for, he would contribute his mite, if that be $25 or $100. He thought the association could and would build such a hall; thus adding another new and interesting feature, and affording Mr. B. the opportunity to cover himself with imperishable laurels and honors.

Col. Colman was glad the matter of exempting fair grounds had been brought up. The agricultural was paramount to any other interest, and what was asked was as little as could be done to favor it.

Judge Wielandy also agreed in this matter. As it now stood the people actually agreed to tax themselves on their fair grounds. They thought it was an oversight in the enactment of the law, now in force, to name only five acres; as if that area were all that was needed for any fair grounds.

Judge Wielandy then urged the use of the Senate Chamber as a very proper place for this Board to hold a public session, to which every one interested should be invited and admitted, and that notice of such meeting should be given through the *State Times*. He wished that the entire State could become acquainted with the State Board of Agriculture, as there were still very many persons in the State who had no knowledge of such an institution, or its labors.

Col. Colman: Will you insure our getting the appropriations we desire after that?

Judge Wielandy: Certainly, sir.

The Judge further stated that as a German and a member of the General Assembly, he was looked upon, in some measure at least, as a representative of that nationality. That he intended at an early day to introduce a bill contemplating the printing of an extract of the annual Agricultural Report of this State in the German language, which need not be very large, and could be done at an expense to the State of about $1,000. That such a public document would be more valued, and would also be of more value, especially to the farmer, than the political speeches which are commonly printed in the German language. He had, in deference to the State Board of Agriculture, deferred this, and hoped the Board would now second his efforts.

Mr. Husmann had observed an omission in the list of premiums recommended for farms, nurseries, orchards, hedges and farm crops, and wished to know why vineyards were not included.

On motion of Col. Colman, it was recommended to offer a premium of $100 for the best vineyard of five acres.

Mr. Husmann thought the requirement of five acres too much; that one acre only should be required, with which view Mr. Harris agreed entirely. Mr. Harris moved to amend so as to read, one acre or more. Amendment passed; the resolution then passed unanimously.

The Board then adjourned to meet at 7 o'clock P. M., unless called sooner by order of the President. Carried.

SECOND SESSION.

The Board met in the room of the Supreme Court pursuant to adjournment.

President Mudd in the chair.

Present—Messrs. Mudd, Essex, Husmann, Lear, Moore, Harris, Kinney, Wielandy, Dyer and Murtfeldt.

Absent—Messrs. Stark and Smith.

Sick—Col. Colman.

President Mudd stated that the Board had come together to hear from the committee, of which Mr. Harris was chairman, and who were expected to report progress in the drafting of bills in the interests of agriculture, to be submitted to the present General Assembly.

Judge Wielandy stated that he had found Col. Colman's original draft of the " stock law," which had been before the last Legislature, but as that gentleman was not present, he wanted the consideration of that bill laid over.

Upon the point that it was constitutional to have the bill so framed as to permit a vote upon it to be taken by counties, there seemed to be but little doubt, as some of the best legal minds in the State had been consulted and expressed themselves clearly and favorably on that point.

Judge Wielandy next read a bill for the preservation of game and small birds—specifically named—which met the sanction of the Board.

The Judge next wished to know how large an appropriation was really needed by the State Board of Agriculture to enable it efficiently to carry on its work, viz: for rent of office of State Entomologist and the Board; premiums for farms, farm crops, orchards; vineyards and nurseries; traveling and actual expenses of the members of the Board; salary for secretary, stationary and express charges, etc., to meet which the Board recommended to ask an annual appropriation of five thousand dollars. Expecting to award a thousand dollars in premiums for the objects above specified this year, and not less than five hundred dollars every year.

Mr. Lear expressed himself fully in favor of a liberal appropriation, and upon the fact that farmers constitute the great body of taxpayers; that much legislation was had, and large sums were expended to favor and encourage almost every other calling, business or pursuit, while the farmers were treated as step-children or aliens; that he failed to find facts which would shed light upon the amount of legislation or the number of laws enacted in the interest of the farmers in Missouri. He had, in his investigation, found that a legislature in another State, in a session of one hundred and seventy-five days, had passed one such act favoring the farmer. As far as he was concerned he was willing to spend and be spent in laboring for the interests of the farmers of Missouri.

The motion to fill the blank with $5,000 was carried.

Judge Wielandy then read "an act to amend an act of the General Statutes of the State, chapter —, sec. 3," so as to read: "That the Governor, the State Superintendent of Public Schools, the Professor of Agriculture and Farm Superintendent of the State University, and the President of the St. Louis Agricultural and Mechanical Association, shall be *ex-officio* members of the State Board of Agriculture. Agreed to.

G. W. Kinney then read the form of a bill of the proposed dog law, favoring the licensing and registering of dogs—every dog to wear a collar with the owner's name and registered number of the dog, etc., with pains and penalties, etc.

The perfecting of this bill was committed to Messrs. Kinney and Wielandy.

The fearful increase of the dreadful hydrophobia was dwelt upon by members—over one hundred deaths from rabies were reported as occurring in the State of Missouri during last year, being ten times the number of those occurring from the bite of rattlesnakes, and as only one person in twenty bitten by a mad dog did die, it would appear there had been over two thousand exposed to this horrible death.

Dr. Dyer stated that when a child he had been bitten by a mad dog, and that annually a certain place on his leg became inflamed, and a small festering head formed, which he opened and cauterized with nitrate of silver, and that possibly he might yet die of hydrophobia.

Judge Wielandy referred to a time when he, with others, had to count and examine the vouchers for which the State had paid a bounty on wolf scalps, and if memory served him there were nineteen hundred of these in one year. How many sheep these wolves had killed it would be hard to estimate—and this was only a small matter when compared to the number of sheep annually destroyed by dogs.

Several gentlemen referred to the admirable essay of G. W. Kinney upon this subject, and read before the State Board of Agriculture, and expressed a wish that all the members of the Legislature could hear it read or read it, and Judge Wielandy, as a member of that body, was importuned to get the facts of the essay before them which he expressed himself willing to do.

Mr. Harris then introduced the following resolution, which, upon motion, was adopted:

Resolved, That this Board earnestly recommend that all fair grounds of agricultural societies in this State should be exempt from all local taxation so long as the same shall be used for fairs exclusively, and we hereby request that the General Assembly of the State of Missouri will pass such laws as will grant the relief herein specified.

Mr. Essex then introduced the following resolution, which upon motion, was adopted:

Resolved, That Judge Wielandy be and is hereby constituted a committee of one to present to the honorable the General Assembly, a joint resolution authorizing the printing, in extracts, of five thousand copies of the State Agricultural Reports in the German language, for the use of the German farmers and the Board of Emigration of our State, to be distributed in such manner as the General Assembly may direct.

Adjourned to meet at the call of the President.

THIRD SESSION.

The Board met in the room of the Supreme Court, Friday, January 27th, A. M.

President Mudd in the chair.

Present—Messrs. Mudd, Essex, Smith, Harris, Kinney, Lear, Dyer, Wielandy and Murtfeldt.

Absent—Messrs. Colman, Husmann, Stark and Moore.

Reading of the minutes of last meeting dispensed with.

Mr. Lear then introduced the following resolution:

Resolved, That in case the General Assembly shall make an appropriation to enable this Board to offer the premiums on farms, farm crops, etc., recommended in a resolution passed by this Board, that the President be empowered and requested to appoint a visiting committee of three, and that said committee, including the President, shall make the rules and regulations under which the entries and awards shall be made.

Passed unanimously.

Notice of a proposed change in the by-laws, to amend section eleven of the by-laws of this Board, so as to read: "These by-laws may be altered at any meeting of the Board by a majority of the members present and voting, provided notice shall be given at a previous meeting of the Board of the amendment proposed."

On discontinuance of the office of Recording Secretary, Mr. Smith contended that Mr. Tice was still the Recording Secretary, and a member of a standing committee of this Board, that the notice given by Col. Colman to vacate the office was not such as was contemplated in the by-laws of the Board (section eleven). He referred to sections one, two and seven of said by-laws. His view was concurred in without objections. Mr. Tice is still Recording Secretary. The Corresponding Secretary was, however, instructed to give notice in writing that it is the intention of the Board to vacate the office.

Mr Smith then introduced the following resolution:

Resolved, That the President be requested to appoint a committee, to include the Secretary and Treasurer of this Board, to make all needful arrangements for the State Board of Agriculture and its officers to take a trip of observation along the Kansas Pacific and Union Pacific railroads, and also that they communicate with the State Board of Agriculture of the State of Kansas and invite their cooperation.

On motion of Mr. Harris, Judge Wielandy was added to the committee, also Col. Colman. Resolution adopted unanimously.

Dr. Dyer introduced the following resolution, which was also adopted without a dissenting vote:

Resolved, That if a suitable hall shall be provided by the St. Louis Agricultural and Mechanical Association, on the fair grounds of said association, that the annual discussions upon leading agricultural topics initiated at the last annual meeting of the State Board of Agriculture, shall be held in such hall and during the fair of said association, under the auspices of the State Board of Agriculture, and that the President appoint a committee to select subjects for discussions at such meeting of the Board.

By Mr. Harris :

Resolved, That thanks of this Board are hereby tendered to the officers representing railroads for renewed favors in furnishing the members of this Board with passes.

The Board then adjourned *sine die.*

REPORT OF CORRESPONDING SECRETARY.

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REPORT OF

CORRESPONDING SECRETARY.

The seasons of the year of 1870 were marked by many peculiarities, if viewed from an agricultural standpoint, and though some of these were against the farmer, most of them were in his favor. His flocks and herds were not decimated by malignant diseases, nor were his fields greatly damaged by severe drought or excessive rainfall. While on the one hand it is true, that the promises of many an orchard or vineyard were blighted, it is nevertheless also true, that there were plenty of well ripened grapes, and scarcely ever a better season for wine, nature herself providing the much valued saccharine in the grapes, in the best ratio. Early in the season all manner of large and small fruits were plenty, but apples and pears had not the keeping quality, hence the limited supply and high prices at this present writing (February 1st).

In making these remarks, the section refers to the State of Missouri as a whole, being well aware that there are localities where much damage was done either by protracted rains or the want of them, and that there are neighborhoods where Texas fever may have raged among cattle, or the cholera among swine; but such localities are few, and form the exceptions to the rule.

The people of this State then have great cause for thankfulness to the Giver of all good, whose promises are yea and amen, and who saith: "Seed time and harvest shall not fail in the earth," etc.

Below will be found in detail, a monthly record of the whole season, and of the progressive development of crops; also a brief meteorological report for the months.

Of the three leading staples it can now be written: "corn was good both in quality and yield; wheat fully up to the average as to quality and about an average yield; hay less than an average in both quality and yield."

The agricultural reports of most of the States are largely filled with the awards of premiums made at State Fairs, and the transactions of State Agricultural Societies incident to holding a State Fair, and so far, are only of value to exhibitors or citizens of the respective States.

At present the State of Missouri does not hold a State Fair nor has she a State Agricultural Society. Instead of this there is a State Board of Agriculture, of twelve charter members, the Governor of the State and the State Superintendent of Public Schools being *ex officio* members of the Board. Presidents of County Agricultural Societies, or duly authorized delegates, one from each county, are also *ex officio* members at the annual meeting of the Board.

The wants, prospects and condition of the agricultural interests of the State are committed to the State Board of Agriculture, these are the topics upon which they are to deliberate and consult, and the result of their deliberations is annually submitted to the General Assembly in the agricultural reports, together with such propositions as, in their view, may need legislative action.

WANTS

Stand first in this trio of obligations. In the preceding chapter of the proceedings of the Board, it will be observed that generally the farmers are interested in the passage of a "*Stock Law*," a "*Dog Law*," and a law "*to prevent the spreading of noxious weeds*." One other general want is: such information as will lead to a correct appreciation and use of labor saving implements. The Board of Agriculture has aimed to give this last named and much needed information, by holding public field trials; first of plows and other soil stirring implements, in October, 1869, and second by holding a field trial of reapers, mowers, harvesters, etc., in June, 1870, a detailed account of which latter trial will be found in this volume. It should be remembered that these trials have cost the State not one cent; while similar trials, held in other States, cost thousands of dollars, our trials have been made self-sustaining. The entry fees charged have been sufficient for the actual outlay, yet it should be remembered that some of the members of the Board and of the awarding committees, labored without fee or reward, actually paying their own expenses. Some one may say *cui bono*, what good does it do? We answer, read the reports, be guided by them in the purchases of your farm machinery, and it is hoped you will be able to give the answer yourself.

OTHER WANTS

May be briefly summed up thus: More attention to clean, pure seed for all farm crops; more and closer study of domestic animals, and a more extended introduction of valuable breeds—especially of males; a greater love for home by the entire farming community, and a higher appreciation of the art and science of correct farming. As an aid in this direction, valuable practical papers are introduced in these annual reports from year to year, and though these are not absolutely faultless, being human productions, yet they furnish much valuable information, and are believed to contain sound doctrine upon the subjects upon which they treat. Another valuable aid is found in the formations of "Farmers' Clubs" in many counties. If these clubs are conducted in a practical, common sense way, and if in the pursuit of knowledge, the social obligations and privileges are kept in view, they promise to be of incalculable benefit, and will contribute largely to the grand total of human happiness, as well as to the productions of the soil.

PROSPECTS.

No one at all conversant or familiar with the progress everywhere discernible throughout the States, with the constant and steady increase of an industrious and intelligent farming population, with the rapid development of all the natural resources of this highly favored State, with the extension and completion of the great net work of railroads, with the building of churches and school houses, with greater facilities for and better markets at home and abroad, with the greater dissemination of agricultural knowledge, and the establishment and opening of an agricultural college in our midst, can resist the conclusion that our prospects are bright, very bright. May God help us to appreciate and improve our privileges!

OUR CONDITION,

Although in a great measure foreshadowed in the preceding paragraphs, will find further explanations and detail in the brief review of seasons and crops of 1870, and also in the reports from counties and county and district agricultural societies.

The Secretary very much regrets that so few counties, or rather the respective officers of county agricultural and mechanical associations, can or do see the importance to themselves of being represented in these annual reports. Could they but be one month in this office and fully realize how solicitously and earnestly information is sought respecting every part of the State, self-interest, if no higher motive would certainly spur them up not to lose another like desirable opportunity to place their respective counties on record.

MONTHLY RECORD OF THE CROPS FOR 1870.

JANUARY.

But little can be predicted during the heart of winter in relation to the crops of the ensuing season. The weather was exceedingly variable, especially for the latter part of the month. In the central portions of the State, the severest cold of the season succeeded in the course of twelve hours, to a summer-like temperature and a summer-like thunderstorm. The snow-fall was inconsiderable, and winter grains and other low plants undoubtedly suffered to some extent for lack of its protection.

FEBRUARY.

The weather for the greater portion of this month was mild and pleasant, with but little frost in the ground, and in some localities farmers and gardeners anticipated the labors of spring by plowing, fencing and making ready for planting. The pleasant weather and bare ground was most favorable for unhoused stock, which could find considerable picking in sheltered places and in the cornfields. The temperature was so genial, that, had there been more moisture, the buds would have swollen so much that they could not have endured the inevitable "late frosts," as it was, though retarded by drought, they pushed considerably.

On the 20th came a great change. The thermometer suddenly went down below zero, and the Frost King again locked all nature in his icy fetters. Very soon after, disheartening reports began to come in about the Peach crop. Cole, Buchanan, Jefferson, and St. Louis counties reported more than half the buds blackened. Apricots were destroyed altogether. The wheat fields were also said to be very much injured. The cold was, however, of short duration, and as February gave place to its successor we were cheered by harbingers of spring in the twitter of the blue bird and robin, in the flutter of insect wings in the sunshine and in glimpses here and there of impatient green leaves peeping up through the brown mould.

MARCH.

This was an exceedingly trying month for both fruit and grain crops, —the latter would have been still more severely injured, had it not been prevented by a heavy fall of snow on the 3rd.

On the 15th occurred one of the fiercest storms of the season; snow and sleet, accompanied by a violent west wind, and a degree of cold experienced but once before during the winter. The cold and wind continued for three days, damaging fruit and other trees extensively.

From the 20th to the end of the month the weather was more seasonable; but one rain succeeding another, left the soil in poor condition for cultivation, and all agricultural labors, in the central sections of the State, were very much retarded.

APRIL.

The month opened with pleasant weather, warm and dry and no frosts to injure the starting vegetation, until the 15th, when a most unseasonable storm of snow and sleet set in, followed, on the 16th by a killing frost, which extended over a great portion of the country, from the extreme north, to Arkansas and Alabama southward.

Orchards and vineyards in the latitude of St. Louis, were in full bloom, and suffered severely. Peach buds, that had escaped the winter storms and frosts, now yielded their life to these untimely blasts from Boreas. The first bloom of the grapes being killed, the crop depended on the development of the latent buds. Strawberries were injured in the same way. Early vegetables were cut down to the ground. Cherries, pears, and even apples were damaged to such an extent that but a very small yield could be expected. Wheat and barley were frozen badly, especially that sown broadcast, and all vegetation was put back at least ten days.

A great breadth of oats was sown this spring in comparison with former years. Corn was also planted extensively, in some localities on the winter-killed wheat fields.

In the southeastern corner of the State many of the ridges were cleared and planted to vines and fruit trees, by German immigrants.

MAY.

May could not, on the whole, be considered, this year, as a very favorable month for the farmer. During the earlier portion it was cool and rainy; good weather for planting trees, but bad for corn. Later in the month succeeded drought and extreme heat.

Advices from Howard, Chariton, Jasper, Saline, Lafayette, Ray, Cole, Jefferson, Carroll, Caldwell, Livingston, Linn and Perry counties were to the effect that scarcely any peaches were maturing, and that the fruit crop generally would be very short. In Howard and contiguous counties wheat also was a failure. Pike and Green counties alone reported a fair show for peaches, and other fruits. Small fruits were much injured by the heat and drought of the latter part of the month.

JUNE.

Vegetation languished in the northern counties for lack of rain. Wheat did not recuperate as thoroughly as it would have done had the temperature been lower and more rain had followed. The yield of hay to the acre was also very short in many localites. Corn was backward but growing, and the dry weather was favorable to its thorough cultivation. Winter barley, though short in straw, promised a large yield. Oats were, almost without exception, poor and low, and many acres were never harvested except by stock. Strawberries and cherries were very scarce. Raspberries, blackberries, currants, etc., were set very full, but needed more moisture to bring them to perfection. Grapes were very promising, and tolerably free from insects. Pears and apples not so thirfty as usual.

In Central Missouri, the drought was succeeded, about the time the grain harvest commenced, by frequent showers, which greatly interrupted operations. The rains, however, extended over but comparatively small areas. In the more southern sections of the State, the harvest was over, and the yield of grain throughout rather below the average, though in some localities it was large. The berry of wheat was fair and plump, and a larger proportion than usual that would inspect as No. 1.

JULY.

The temperature was uniformly high during the entire month, and though there were occasional showers they were extremely local, and a general drought prevailed.

The yield of wheat was found, after threshing, to be fully up to the average, taking the whole State, for though it did not produce as much per acre, yet the area sown was much greater than in preceding years, and thus the deficiency was made up, and the quality was very fine. Oats and barley filled out well, but the straw was very short. Hay was only about half a crop even in the best grass regions. Corn, though doing well, will scarcely average as many bushels as usual. Chinch bugs infested it in great numbers in some sections, but it was too far advanced to suffer material injury.

AUGUST.

There were a considerable number of showers during this month, and the mean temperature was not so high as in July. Corn and vegetables matured finely. The markets were quite full of fruits, but mostly of an inferior quality, and not in condition to keep well. Potatoes suffered very much from the ravages of the Colorado Potato-Beetle, and it was only by constant exertions on the part of the growers, that a small proportion of the crop was saved from destruction. Sweet Potatoes yielded remarkably well this year, and were of very superior quality.

SEPTEMBER.

A little more rain this month would have made the weather everything that could be desired. There was no frost, and no extremes of heat, but a succession of delicious days, with only a suggestion of autumn in the brown grass and in an occasional golden and crimson leaf on the trees.

Corn, however, late, matured finely, and produced better than farmers had expected. Plowing and seeding of fall grain progressed without interruption, though there was scarcely sufficient moisture to promote the growth of the latter. The Hessian Fly made its appearance in a number of counties, and a new enemy—the Fall Army-worm—passed in great numbers over many fine fields, devouring every green blade, but, it is hoped, not entirely destroying the plants, so that they will start again. Grapes, in most localities, were very abundant, and of excellent quality; they were by far the most satisfactory fruit crop of the season.

OCTOBER, NOVEMBER, DECEMBER.

The concluding months of the year were, with the exception of a few days in December, mild and delightful, with scarcely frost enough to kill the most delicate flowers until late in November. Tree planting was carried on to a much greater extent than usual, and all preparations for winter could be made with the utmost ease.

The unseasonable warmth was in some respect injurious to vegetation. In sugar making regions the maple trees started the flow of sap, and large quantities of sugar were manufactured in November. Fruit trees started new leaves, budded, blossomed, and even set fruit, mostly on very young trees, and in particularly warm situations, but all the peach buds swelled sufficiently to render them unusually susceptible to injury by frosts.

On the 19th of December there was a heavy fall of snow succeeded by several of the coldest days on record for this latitude, the thermometer marking 16° below zero on the 24th, and fruit-growers felt their hearts fail them for their next year's crop. Their fears were verified as soon as examinations could be made, for not only were the fruit-buds killed on the peach trees, but in many cases the trees themselves were injured. Raspberries and blackberries were also cut back, but it is hoped the berry crop is not entirely destroyed for the ensuing summer.

METEOROLGICAL TABLE.

BY A. FENDLER, ESQ., ALLENTON, MO.

JANUARY, 1870.

Thermometer in open air, in the shade—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
26°.2	41°.7	30°.5	32°.8

Maximum temperature 64°.0, on the 12th, 2 P. M.
Minimum temperature 6°.0, on the 8th, 7 A. M.
Range, 58°.0
Wet bulb thermometer.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
25°.0	36°.5	28°.6	30°.0

Barometer—height reduced to freezing point.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.593	29.563	29.578	29.578

Maximum, 30.104, on the 8th, 2 P. M.
Minimum, 28,796, on the 16th, 7 P. M.
Range, 1.308 inches.
Rain on the 5th, 11th, 14th, 16th, 22d, 31st.
Snow on the 3d, 26th.
Total amount of rain and melted snow in guage, 2.31 inches.
Total depth of snow, ¾ inch.

	Average temp.	Rain and melted snow in guage, inches.	Depth of snow, inches.
Jan. 1867,	22°.0	2.66	13¼
Jan. 1868,	24°.2	1.69	2¾
Jan. 1869,	36°.6	1.94	0
Jan. 1870,	32°.8	2.31	¾

FEBRUARY, 1870.

Thermometer in open air, in the shade.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
27°.4	47°.1	31°.9	35°.5

Maximum temperature 71°.0, on the 26th, 11 A. M.
Minimum temperature —1°.0, on the 20th, 7 A. M.
Range, 72°.0.
Wet bulb thermometer.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
25°.4	38°.0	29°.0	30°.8

Barometer—height reduced to freezing point.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.489	29.449	29.470	29.469

Maximum, 29.953, on the 20th, 7 A. M.
Minimum, 28.732, on the 26th, 4 P. M.
Range, 1.221 inches.
Rain on the 26th.
Snow on the 7th and 17th.
Total amount of rain and melted snow in guage, 0.59 inches.
Total depth of snow, 1 inch.

	Average temp.	Rain and melted snow in guage, inches.	Depth of snow, inches.
Feb. 1867,	38°.1	3.48	2¼
Feb. 1868,	33°.2	0.82	1¼
Feb. 1869,	36°.0	2.45	2⅝
Feb. 1870,	35°.5	0.59	1

MARCH, 1870.

Thermometer in open air, in the shade—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
34°.0	49°.3	37°.4	40°.2

Maximum temperature, 70°.0, on the 10th, 2 P. M.
Minimum temperature, 7°.0, on the 15th, 7 A. M.
Range, 63°.0.

Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
32°.3	41°.8	34°.8	36°.3

Barometer—height reduced to freezing point—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.496	29.448	29.476	29.473

Maximum, 29.936, on the 23d, 2 P. M.
Minimum, 28,420, on the 12th, 12:40, P. M.
Range, 1.516 inches.
Rain on the 3d, 5th, 12th, 14th, 25th, 26th, 29th, 30th, 31st.
Snow on the 1st, 3d, 12th, 14th, 15th, 16th.
Total amount of rain and melted snow in guage, 4.95 inches.
Total depth of snow, 5¾ inches.

	Average temp.	Rain and melted snow in guage, inches.	Depth of snow, inches.
March, 1867,	33°.4	2.76	4½
March, 1868,	50°.2	8.87	½
March, 1869,	39°.1	4.21	1⅞
March, 1870,	40°.2	4.95	5¾

APRIL, 1870.

Thermometer in open air, in the shade—

7. A. M.	2. P. M.	9 P. M.	Mean of month.
47°.5	68°.5	51°.9	56°.0

Maximum temperature, 93°.0, on the 23d, 2 P. M.
Minimum temperature, 26°.0, on the 16th, 5 A. M.
Range, 67°.0.
Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
43°.8	53°.5	46°9	48°.1

Barometer—height reduced to freezing point—

7. A. M.	2 P. M.	9 P. M.	Mean of month.
29.528	29.485	29.494	29.502

Maximum, 29.765, on the 5th, 7 A. M.
Minimum, 28.269, on the 22d, 2d P. M.
Range, 0.496 inches.
Rain on the 1st, 13th, 14th, 15th, 26th, 28th.
Snow on the 15th, 16th.
Total amount of rain and melted snow in guage, 2.60 inches.
Total depth of snow, 2⅛ inches.

	Average temp.	Rain and melted snow in guage, inches.	Depth of snow, inches.
April, 1867,	55°.0	0.89	0
April, 1868,	51°.4	6.05	0
April, 1869,	54°.3	6.08	¼
April, 1870,	56°.0	2.60	2⅛

MAY, 1870.

Thermometer in open air, in the shade—

7. A M.	2 P. M.	9 P. M.	Mean of month.
58°.7	81°.2	61°.0	67°.0

Maximum temperature, 96°.0, on the 21st, 2 P. M.
Minimum temperature, 37°.0, on the 11th, 5 A. M.
Range, 59°.0.
Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
56°.1	64°.9	57°.6	59°.5

Barometer—height reduced to freezing point—

7 A. M.	2 P. M.	9. P. M.	Mean of month.
29.472	29.418	29.429	29.440.

Maximum, 29.725, on the 14th, 7 A. M.
Minimum, 28.880, on the 7th, 7 A. M.
Range, 0.845 inches.
Rain the 3d, 5th, 7th, 9th, 11th, 23d, 30th and 31st.
Total amount of rain, 2.57 inches.

	Average temp.	Rain in gauge.
May, 1867,	59°·5	7.86
May, 1868,	65°.1	5.71
May, 1869,	63°.1	3.71
May, 1870,	67°.0	2.57

JUNE, 1870.

Thermometer in open air, in the shade—

7. A. M.	2. P. M.	9 P. M.	Mean of month.
64°.6	84.°8	66°.3	71°.9

Maximum temperature, 99°.0, on the 29th, 2 P. M.

Minimum temperature, 46°.0, on the 11th, 5 A. M.

Range, 53°.0.

Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
63°.8	72°.5	65°.2	67°.2

Barometer—height reduced to freezing point—

7 A. M.	2. P. M.	9 P. M.	Mean of month.
29.516	29.468	29.471	29.485

Maximum, 29.721, on the 23d, at 7 A. M.

Minimum, 29.234, on the 30th, 9 P. M.

Range, 0.487 inches.

Rain on the 6th, 7th, 8th, 9th, 10th, 12th, 13th, 14th, 15th, 16th, 24th, 25th, 30th.

Total amount of rain, 4.88 inches.

	Average temp.	Rain in gauge.
June, 1867,	73°.0	5.14 inches.
June, 1868,	71°.9	1.67 "
June, 1869	68°.4	8.14 "
June, 1870,	71°.9	4.88 "

JULY, 1870.

Thermometer in open air, in the shade.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
67°.1	85°.0	68°.5	73°.5

Maximum temperature 98°.0. on the 6th, 2 P. M.

Minimum temperature 51°.0, on the 34th, 6 A. M.

Range, 47°.0

Wet bulb thermometer.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
66°.5	74°.4	67°.5	69°.5

Barometer—height reduced to freezing point.

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.531	29.487	29.492	29.503

Maximum, 29.762, on the 20th, 7 A. M.

Minimum, 29.257, on the 17th, 7 A. M.

Range, 0.505 inches.

Rain on the 2d, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 19th 29th.

Total amount of rain 5.99 inches.

	Average temp.	Rain in gauge.
August, 1867,	76°.5	2.25 in.
August, 1868,	72°.2	5.54 "
August, 1869,	77°.1	2.75 "
August, 1870,	73°.5	5.99 "

AUGUST, 1870.

Thermometer in the open air in the shade—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
67°.1	85°.5	68°.5	73°.5

Maximum temperature 98°.0 on the 6th, 2 P. M.
Minimum temperature 51°.0 on the 30th, 6 A. M.
Range 47.°0
Wet bulb thermometer—

7 A. M.	2 P. M,	9 P. M.
66°.5	74°.4	67°.5

Barometer—height reduced to freezing point—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.531	29.487	29.492	29.503

Maximum 29.782 on the 20th, 7 A. M.
Minimum 29.257 on the 17th, 7 A. M.
Range 0.505.
Rain on the 2d, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 19th, 29th.
Total amount of rain in gauge 5.99 inches.

	Average temperature.	Rain in guage.
August, 1867,	76°.3	2.25 inches.
August, 1868,	72°.2	5.54 "
August, 1869,	77°.1	2.75 "
August, 1870.	73°.5	5.99 "

SEPTEMBER, 1870.

Thermometer in open air in the shade—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
61°.3	81°.0	64°.0	68°.8

Maximum temperature 97°.0 on the 7th, 2 P. M.
Minimum temperature 48°.0 on the 25th, 6 A. M.
Range 49°.0
Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
60°.7	70°.0	62°.7	64°.5

Barometer—height reduced to freezing point—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.573	29.522	29.540	29.545

Maximum 29.750, on the 18th, 7 A. M.
Minimum 29.333, on the 3d, 9 P. M.
Range 0.417 inches.
Rain on the 2d, 3d, 5th, 10th, 12th, 14th, 24th, 26th, 29th.
Total amount of rain in guage 0.99 inches.

	Average temperature.	Rain in guage.
September, 1867,	69°.2	0.52 inches.
September, 1868,	62°.5	7.19 "
September, 1869,	65°.7	1.60 "
September, 1870,	68°.8	0.99 "

OCTOBER 1870.

Thermometer in open air in shade—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
48°.8	68°.7	52°.8	56°.8

Maximum temperature, 85°.0 on the 15th, 2 P. M.
Minimum temperature, 29°.0 on the 31st, 7 A. M.
Range 56°.0.

Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
48°.4	58°.6	51°.2	52°.7

Barometer—height reduced to freezing point—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.585	29.532	29.560	29.559

Maximum 29.839, on the 18th, 7 A. M.
Minimum 29.118, on the 30th, 7 P. M.
Range 0.721 inches.
Rain on the 1st, 10th, 16th, 17th, 19th, 28th, 29th and 30th.
Total amount of rain in gauge 4.13 inches.

	Average temperature.	Rain in gauge.
October, 1867,	56°.1	1.54 inches.
October, 1868,	54°.4	1.90 "
October, 1869,	55°.6	2.74 "
October, 1870,	56°.8	4.13 "

NOVEMBER, 1870.

Thermometer in open air in the shade—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
36°.3	58°.4	42°.9	45°.9

Maximum temperature 80°.0, on the 4th, 2 P. M.
Minimum temperature 14°.0, on the 22d, 7 A. M.
Range 66°.0.

Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
35°.5	49°.0	40°.0	41°.5

Barometer—height reduced to freezing point—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.602	29.545	29.581	29.576

Maximum 29.972, on the 18th, 7 A. M.
Minimum 29.167 on the 8th, 2 P. M.
Range 0.805 inches.
Rain on the 4th, 8th, 11th, 14th, 29th.
Total amount of rain in gauge 2.16 inches.

	Average temp.	Rain in gauge.	Snow inches.
November, 1867,	45°.0	2.24 inches.	2½
November, 1868,	42°.9	2.01 "	¼
November, 1869,	39°.8	5.69 "	1⅛
November, 1870,	45°.9	2.16 "	0

This has been the warmest November I have seen in this latitude.

DECEMBER, 1870.

Thermometer in open air in the shade—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
23°.1	39°.0	26°.7	29°.6

Maximum temperature 64°.0 on the 4th, 2 P. M.
Minimum temperature 16°.0 below zero on the 24th, 7 A. M.
Range 80°.0
Wet bulb thermometer—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
22°.1	33°.7	25°.4	27°.1

Barometer—height reduced to freezing point—

7 A. M.	2 P. M.	9 P. M.	Mean of month.
29.621	29.590	29.613	29.608

Maximum barometer 30.163, on the 24th, 7 A. M.
Minimum barometer 29.003, on the 19th, 2 P. M.
Range 1.160 inches.
Rain on the 6th, 10th, 11th.
Snow on the 17th, 19th, 23d, 28th.
Total amount of rain and melted snow in guage 2.85 inches.
Total depth of snow, 8⅞ inches.

	Average temperature.	Rain and melted snow in gauge.	Snow inches.
December, 1867,	36°.1	2.60 inches	5⅜
December, 1868,	28°.5	3.22 "	9½
December, 1869,	33°.0	2.70 "	1½
December, 1870,	29°.6	2.85 "	8⅞

ST. LOUIS FARM PRODUCTS MARKET.

Giving the maximum and minimum prices paid each month during the year 1870, for the principal farm products, together with the monthly receipts and exports, compiled chiefly from the market reports of the St. Louis *Democrat:*

WHEAT.

January, 1870.

Receipts, 188,736 bushels; exports, 4,017 bushels.

	Maximum price for the month.	Minimum price for the month.
Choice Red Winter	$1 35	$1 17
Choice White Winter	1 45	1 25
Choice Spring	0 98	0 90

February.

Receipts, 254,217 bushels; exports, 6,595 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 30	$1 15
Choice White Winter	1 40	1 30
Choice Spring	1 00	0 93

March.

Receipts, 437,890 bushels; exports, 39,947 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 25	$1 18
Choice White Winter	1 40	1 25
Choice Spring	0 93	0 80

April.

Receipts, 437,890 bushels; exports, 39,947 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 35	$1 18
Choice White Winter	1 45	1 25
Choice Spring	0 88	0 80

May.

Receipts, 529,709 bushels; exports, 18,972 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 50	$1 25
Choice White Winter	1 60	1 30
Choice Spring	0 98	0 92

June.

Receipts, 354,610 bushels; exports, 31,651 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 38	$1 20
Choice White Winter	1 45	1 30
Choice Spring	1 08	0 95

July.

Receipts, 749,885 bushels; exports, 70,260 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 40	$1 22
Choice White Winter	1 50	1 25
Choice Spring	1 20	0 98

August.

Receipts, 917,719 bushels; exports, 113,787 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 55	$1 25
Choice White Winter	1 65	1 37½
Choice Spring	1 23	1 00

September.

Receipts, 720,188 bushels; exports, 150,533 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 32	$1 09
Choice White Winter	$1 50	1 25
Choice Spring	1 07	0 85

October.

Receipts, 533,804 bushels; exports, 264,932 bushels.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 38	$1 27½
Choice White Winter	1 60	1 40
Choice Spring	1 10	1 00

November.

Receipts, 776,352 bushels; exports, ———.

	Maximum Price.	Minimum Price.
Choice Red Winter	$1 50	$1 25
Choice White Winter	1 60	1 40
Choice Spring	1 12	1 00

December.

Receipts 588,985 bushels; exports ——.

	Maximum price.	Minimum price.
Choice Red Winter	$1 45	$1 33
Choice White Winter	1 60	1 40
Choice Spring	1 13	1 07

CORN.

January, 1870.

Receipts, 212,195 bushels; exports, 135,161 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	85c	77c	68c	55c
Yellow	81	71	65	65
Mixed	80	69	68	60

February.

Receipts, 425,524 bushels; exports, 217,077 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	88c	77c	70c	62c
Yellow	79	70	68	60
Mixed	77	71	65	58

March.

Receipts, 425,486 bushels; exports, 364,163 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	86c	76c	75c	65c
Yellow	83	70	75	60
Mixed	82	71	65½	56

April.

Receipts, 587,239 bushels; exports, 458,019 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	$1 07	92c	80c	77c
Yellow	1 05	91½	79	77
Mixed	1 02	90	75	69

May.

Receipts, 989,361 bushels; exports, 619,837 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	$1 25	$1 10½	80c	80c
Yellow	1 16	1 05	85	84
Mixed	1 18	1 05	70	75

June.

Receipts, 804,582 bushels; exports, 579,149 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	$1 06	95c	75c	80c
Yellow	1 02	90	25	70
Mixed	1 06	92	65	63

July.

Receipts, 465,974 bushels; exports, 331,972 bushels.

	Maximum price.		Minimum price	
	Sacks.	Bulk.	Sacks.	Bulk.
White	$1 08	97c	80c	76c
Yellow	97	85	70	66
Mixed	98	98	66	65

August.

Receipts, 296,526 bushels; exports, 270,002 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	99c	80c	70c	63c
Yellow	94	86	65	62
Mixed	90	83	56	55

September.

Receipts, 105,145 bushels; exports, 181,186 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	76c	70c	61c	60c
Yellow	72	64	60	50
Mixed	70	63	53	50

October.

Receipts, 49,946 bushels; exports, 151,845 bushels.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	72c	62c	56c	52½c
Yellow	70	64	57	51
Mixed	68	60	50	47

November.

Receipts, 134,373 bushels; exports, ——.

	Maximum price.		Minimum price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	80c	87c	55c	45c
Yellow	70	60	55	40
Mixed	70	60	55	38

December.

Receipts, 193,000 bushels; Exports, ——.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	64c.	50c.	50c.	42c.
Yellow	59	50	52	43
Mixed	56	47	48	39

OATS.

January.

Receipts, 182,397 bushels; Exports, 114,520 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	58c.	51c.	52c.	51c.
Black	57	...	54½	...
Mixed	56	51	45	46

February.

Receipts, 269,985 bushels; exports, 190,912 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	58c.	50c.	48c.	48½c.
Black	57	...	53	...
Mixed	55	49½	49	43

March.

Receipts, 216,500 bushels; exports, 165,267 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	70c.	...	46c.	...
Black	55	...	50	...
Mixed	54	47	44	42

April.

Receipts, 355,766 bushels; exports, 255,244 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	63c.	54c.	51c.	54c.
Black	...	...	...	...
Mixed	54	69	49	46

May.

Receipts, 758,808 bushels; Exports, 619,220 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	66c.	56c.	56c.	56c.
Black	55	...	55	...
Mixed	66	67	55	50

June.

Receipts, 528,893 bushels; exports, 308,402 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	60c.	53c.	50c.	53c.
Black	...	...	...	...
Mixed	58½	54	45	49½

July.

Receipts, 440,972 bushels; exports, 333,626 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	60c.	51c.	44c.	37c.
Black	...	...	...	...
Mixed	58	53	35	34

August.

Receipts, 487,193 bushels; exports, 303,619 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	48c.	41c.	41c.	38c.
Black	...	...	...	...
Mixed	45	40	35	33

September.

Receipts, 351,673 bushels; exports, 269,317 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	45c.	39c.	39c.	30c.
Black	43	...	...	...
Mixed	45½	38	30	29

October.

Receipts, 420,774 bushels; exports, 151,845 bushels.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	47c.	40c.	40c.	36c.
Black	...	...	...	...
Mixed	45	40	37½	35

November.

Receipts, 366 bushels; exports, ———.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	47c.	44½c.	40c.	37½c.
Black	45	...	43	...
Mixed	45	40½	38½	36½

December.

Receipts, 164,479 bushels; exports, ———.

	Maximum Price.		Minimum Price.	
	Sacks.	Bulk.	Sacks.	Bulk.
White	46½c.	46c.	41c.	40c.
Black	...	...	...	...
Mixed	46	45	40	34

BARLEY AND RYE.

January.

Receipts, Barley, 16,602 bushels; Rye, 2,657 bushels.
Exports, Barley, 4,104 bushels; Rye, 756 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 60	$1 40
Spring barley	1 35	1 25
Rye	85	68

February.

Receipts, Barley, 35,463 bushels; Rye, 11,295 bushels.
Exports, Barley, 4,557 bushels; Rye, 2,837 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 40	$1 37
Spring barley	1 25	25
Rye	83	65

March.

Receipts, Barley, 39,110 bushels; Rye, 16,395 bushels.
Exports, Barley, 6,029 bushels; Rye, 8,437 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 55	78c.
Spring barley	1 30	30
Rye	80	65

April.

Receipts, Barley, 40,611 bushels; Rye, 29,716 bushels.
Exports, Barley, 5,086 bushels; Rye 11,561 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 20	80c.
Spring barley	1 35	25
Rye	80	50

May.

Receipts, Barley, 29,170 bushels; Rye, 32,060 bushels.
Exports, Barley, 4,233 bushels; Rye, 17,426 bushels.

	Maximum Price.	Minimum Price.
Winter barley	......	......
Spring barley	$1 10	40c.
Rye	86	75

June.

Receipts, Barley, 4,489 bushels; Rye, 22,025 bushels.
Exports, Barley, 1,773 bushels; Rye, 15,111 bushels.

	Maximum Price.	Minimum Price.
Winter barley	......	......
Spring barley	$1 05	38c.
Rye	85	73

July.

Receipts, Barley, 4,060 bushels; Rye, 15,014 bushels.
Exports, Barley, 2,900 bushels; Rye, 17,740 bushels.

	Maximum Price.	Minimum Price.
Winter barley	......	......
Spring barley	$1 00	48c.
Rye	88	60

August.

Receipts, Barley, 22,330 bushels; Rye, 15,553 bushels.
Exports, Barley, 3,455 bushels, Rye, 7,481 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 30	$1 00
Spring barley	1 17½	25
Rye	85	55

September.

Receipts, Barley, 141,376 bushels; Rye, 19,258 bushels.
Exports, Barley, 7,511 bushels; Rye, 9,649 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 30	50c.
Spring barley	1 17	25
Rye	85	55

October.

Receipts, Barley, 178,723 bushels; Rye, 20,148 bushels.
Exports, Barley, 11,503 bushels; Rye, 4,849 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 25	50c.
Spring barley	1 15	25
Rye	80	55

November.

Receipts, Barley, 17,281 bushels; Rye, 14,275 bushels.
Exports, Barley, 10,295 bushels; Rye, 1,111 bushels.

	Maximum Price.	Minimum Price.
Winter barley	$1 10	40c.
Spring barley	1 12½	30
Rye	75	60

December.

Receipts—Barley, 77,803 bushels; Rye, 7,830 bushels.
Exports—Barley, 8,630 bushels; Rye, 3,301 bushels.

	Maximum Price.	Minimum Price.
Winter Barley	$1 60	$1 45
Spring Barley	1 25	1 15
Rye	0 84	0 78

COTTON.

St. Louis will eventually become an important market for cotton. At present her receipts are principally from Missouri, Arkansas and Tennessee. But as she extends her railroad system and fosters her Red river trade, she will draw upon the better grades of Texas and Louisiana cottons, and in time become one of the heaviest primary cotton receiving markets in the country. At the late State Fair special premiums to the amount of $5,000 were given to cotton growers by the business men of St. Louis. This liberality upon the part of this city, and her evident desire to extend her commercial relations with the South, has had, and is having, a good effect, and in the proper period will bear abundant fruit. We need a steam cotton press in this city, and believe a company could be established to press cotton were an effort made. But everybody seems too busy just now to put the matter afloat. The receipts of cotton for the year have been 11,304 bales. Prices by the month have ruled as follows:

	Lowest.	Highest.		Lowest.	Highest.
January	22	24¾	July	12	19½
February	18	24½	August	10	24
March	13	22½	September	15½	18½
April	13	22½	October	12½	16½
May	12	22	November	12⅞	15½
June	13	21½	December	12	15

TOBACCO.

Offerings at Warehouses each Month.

Month.	Total Hdds.	Reviews.	Original.	Total Boxes.
January	164	30	134	84
February	321	35	286	91
March	578	47	531	96
April	1,067	905	962	193
May	1,401	153	1,248	186
June	1,693	138	1,556	226
July	1,217	217	1,000	101
August	1,353	210	1,143	102
September	811	204	607	43
October	768	225	543	56
November	441	147	294	45
December	202	65	137	59

AVERAGE MONTHLY PRICES.

Month.	Factory lugs...	Planters' lugs.	Common leaf.	Medium shipping leaf...	Good shipping leaf.........	Medium manufacturing...	Good manufacturing...	Fine manufacturing.......
January	$5 65	$7 90	$8 00	$9 00	$10 25	$10 00	$15 25	$23 35
February	4 90	7 35	7 75	8 80	10 00	10 50	16 50	30 40
March	5 75	8 10	8 25	9 00	10 50	10 50	16 50	30 40
April	5 80	8 00	8 10	9 10	10 25	10 50	18 00	44 25
May	7 25	8 50	8 75	9 25	10 50	11 00	18 25	49 40
June	7 00	8 40	8 65	9 15	10 75	10 50	18 60	67 85
July	7 10	8 60	8 75	9 25	10 75	10 50	18 49	34 10
August	6 25	8 10	8 40	9 10	10 65	9 75	18 00	37 65
September	5 70	7 75	8 00	9 00	10 50	9 50	17 75	33 40
October	5 50	7 50	7 90	9 25	10 80	9 50	16 75	35 40
November	5 20	7 00	7 50	9 25	10 40	9 25	17 00	38 15
December	5 10	7 00	7 50	9 10	10 25	10 50	18 50	31 50

The receipts are made up to the 28th inst., and, at close of the year, will not vary more than one or three hhds., if even that, as there is none coming forward.

RECAPITULATION.

Stock on hand January 1, 1870		403 hhds.	
Received during 1870 (1,257 boxes)		11,043 hhds—	11,446
Exports direct in 1870	1,443 hhds.		
Exports from warehouse	4,240 hhds—	4,683	
City consumption		4,950—	10,633
Stock on hand December 28, 1870			813

Of the total receipts, about 2,000 hhds were from Illinois, Kentucky and Tennessee—balance Missouri.

HAY.

The business in hay, by reason of the prolonged drouth last summer reducing the crop, falls a trifle behind the business of 1869, but the range of prices is comparatively higher. The following shows the limits by the week for the entire year:

		Lowest.	Highest.
Week ending	January 8	$12 50	$17 00
“	January 15	12 00	19 00
“	January 22	10 00	17 75
“	January 29	12 25	19 50
“	February 5	15 50	19 00
“	February 12	10 00	19 00
“	February 19	13 00	17 00
“	February 26	11 00	18 50
“	March 5	12 00	18 50
“	March 12	11 00	18 00
“	March 19	13 00	18 00
“	March 26	11 00	17 50
“	April 2	13 00	18 50
“	April 9	10 00	19 00
“	April 16	10 00	19 50
“	April 23	8 50	19 50
“	April 30	13 00	18 50
“	May 7	13 00	19 00
“	May 14	12 00	19 50
“	May 21	13 00	19 00
“	May 28	12 00	18 00
“	June 4	7 50	17 50
“	June 11	12 25	16 50
“	June 18	11 00	17 50
“	June 25	12 00	16 50
“	July 2	13 00	20 00
“	July 9	14 00	18 00
Week ending	July 16	13 00	18 50
“	July 23	14 50	18 00
“	July 30	12 00	19 00
“	August 6	15 00	17 50
“	August 13	15 50	18 00
“	August 20	12 00	19 50
“	August 27	14 00	20 00
“	September 3	14 00	19 00
“	September 10	14 00	18 00
“	September 17	14 00	18 00
“	September 24	14 00	18 50
“	October 1	14 00	18 50
“	October 8	12 00	19 50
“	October 15	9 50	20 00
“	October 22	9 00	18 50
“	October 29	13 00	20 00
“	November 5	14 00	21 00
“	November 12	15 50	21 00
“	November 19	13 50	21 00
“	November 26	16 00	20 00
“	December 3	14 00	21 00
“	December 10	12 00	21 00
“	December 17	12 00	20 00
“	December 24	16 00	20 00
“	December 31	15 50	20 75

APPLES.

Monthly market limits were as follows:

	Per bbl.
January	$1 25@5 00
February	1 25@5 00
March	1 50@5 00
April	1 45@5 00
May	2 00@7 00
June	....
July	$1 00@5 50
August	1 00@4 00
September	1 00@4 25
October	1 20@5 00
November	1 25@5 00
December	1 50@5 00

EGGS.

The past year has been prolific of eggs and everything which related to the poultry line, and prices ranged down to eight cents per dozen during July. The monthly extremes of the market were as follows:

	Lowest.	Highest.
January	18c	30c
February	14c	20c
March	14c	20c
April	12c	20c
May	11c	16c
June	12c	22c
July	8c	16c
August	16c	20c
September	14c	20c
October	19c	20c
November	26c	33c
December	26c	32c

WOOL.

Business has been pretty active throughout the year, and prices show a fair average. The monthly limits of the market have been as follows:

	Tub, ℔ lb.	Fleece, ℔ lb.		Tub, ℔ lb.	Fleece, ℔ lb.
January	45@50	35@40	July	33@44	30@46
February	45@53	33@40	August	36@46	31@41
March	45@53	33@40	September	40@47	30@41
April	43@53	26@45	October	40@48	30@41
May	35@46	30@42	November	40@48	30@41
June	35@46	30@42	December	40@48	30@41

LIVE CHICKENS.

The market for chickens, as well as for all other kinds of poultry, has been overstocked and low. Prices by the month have ruled as follows, the extreme range including young and old:

	Per doz.		Per doz.
January	None offered.	July	$1 25@5 50
February	None offered.	August	1 50@5 25
March	$4 00@4 50	September	2 00@5 00
April	4 00@6 00	October	1 50@5 00
May	3 00@6 00	November	2 50@4 00
June	1 50@6 00	December	2 00@3 00

BUTTER.

The general range for the year on good, sweet samples, has been higher than it was last year, but there has been a large stock of inferior and positively bad butter on the market, which bring our inside figures down quite low. The market limits by the month have ruled as follows:

	Per lb.		Per lb.
January	16@34	July	13@28
February	15@53	August	13@29
March	14@36	September	14@32
April	12@37	October	15@45
May	11@29	November	13@35
June	11@25	December	10@43

SEEDS.

Most of the flaxseed received has been consumed by local manufacturers of linseed oil. Prices have had the following monthly limit for the past year. The price is stated by the bushel:

	Timothy.	Clover.	Flaxseed.	Hempseed.
January	$2 75@4 35		$1 00@1 50	
February	3 75@4 25	$9 25@ 9 75	1 00@2 00	$2 25
March	3 50@4 75	8 25@ 9 75	1 51@2 15	2 50
April	2 50@6 00	8 25@10 00	60@1 85	2 25@2 00
May			1 50@1 75	2 25@2 75
June			1 50@1 75	2 00@2 50
July			1 50@1 75	2 00@2 75
August	3 25@5 75	11 00@11 25	1 75@2 50	2 85@3 00
September	3 50@5 40	10 00@10 50	75@1 75	3 00@3 26
October	3 00@4 85	6 50@ 3 00	1 25@1 75	2 00@3 05
November	3 60@4 25	6 00@ 6 25	1 60@1 65	1 75@2 60
December	4 75@5 25	6 00@ 7 00	1 25@1 65	2 25@2 50

CASTOR BEANS.

Receipts are about all manufactured into oil here. Prices ruled by the month as follows:

	Per bushel.		Per bushel.
January	$1 50@2 25	July	$1 75@3 25
February	1 50@2 00	August	2 00@2 50
March	2 00@3 00	September	2 00@2 50
April	2 90@3 30	October	1 60@2 25
May	3 00@3 30	November	1 25@1 60
June	1 75@3 30	December	1 50@2 50

WHITE BEANS.

Prices ranged for the year by the month as follows:

	Per bushel.		Per bushel.
January	$1 25@3 25	July	75@2 75
February	1 00@3 00	August	75@2 75
March	50@3 00	September	$1 00@2 65
April	50@3 00	October	1 25@2 75
May	75@2 80	November	55@2 45
June	75@2 75	December	50@2 30

HEMP.

Prices have ruled by the month as follows:

	Dressed per ton.	Undressed per ton.
January	$225 00@240 00	$125 00@175 00
February	220 00@240 00	125 00@175 00
March	220 00@240 00	100 00@160 00
April	225 00@230 00	110 00@155 00
May	220 00@235 00	115 00@175 00
June	220 60@240 00	135 00@195 00
July	220 00@225 00	112 50@190 00
August	230 00@250 00	112 50@200 00
September	240 00@260 00	140 00@190 00
October	245 00@275 00	140 00@225 00
November	290 00@300 00	220 00@250 00
December	290 00@300 00	140 00@250 00

POTATOES.

The drouth in this State and in Minnesota limited the supply of potatoes, and the range of the market was therefore higher during the past year than was the case in the preceding one. The monthly market limits were as follows:

	PEACHBLOWS.		ALL OTHER KINDS.	
	Per bushel.	Per barrel.	Per bushel.	Per barrel.
January	55@ 55	$1 90@3 00		$1 30@3 00
February	30@ 40	1 30@2 00		1 00@2 75
March	35@ 50	1 40@1 75	31@ 32	75@2 25
April	34@ 52½	1 40@1 70	21@ 43	70@1 65
May	40@ 77½	1 45@6 50	20@ 75	96@5 50
June	30@1 30	1 75@5 00	45@ 65	1 75@6 50
July	25@ 35		85@ 85	1 00@4 00
August			55@ 85	1 00@2 75
September	$1 00@1 20	2 75@3 00	$1 00@1 10	1 65@3 40
October	60@1 20	1 70@3 35	32½@1 30	1 60@3 50
November	50@ 90	1 75@2 50	35@ 90	1 50@2 35
December	60@ 95	2 15@2 75	55@ 90	2 00@3 00

ONIONS.

The market limits by the month have been as follows:

	Per bushel.	Per barrel.
January	$1 50@1 75	$3 50@4 20
February		3 75@6 00
March	2 00@2 50	4 00@6 55
April	75@1 35	1 50@5 50
May		3 50@7 00
June		2 75@3 75
July		1 50@3 55
August	80@ 80	2 25@4 55
September	1 60@1 75	2 00@5 05
October	60@1 40	2 00@3 70
November	60@1 20	2 25@2 70
December	50@1 40	2 50@4 20

DRIED FRUIT.

Prices have ruled as follows, by the month:

	Apples. per ℔.	Peaches. per ℔.
January	6 @8½	7 @10
February	5½@8	7 @10
March	5 @8¼	7 @10
April	4 @8	5 @ 9½
May	5 @7¾	5 @ 8½
June	4 @8	2 @ 8
July	5¾@9	6 @10½
August	4 @9	7 @10
September	3 @9	5 @ 9
October	4 @8½	5½@10
November	3 @7½	6¾@10½
December	4 @8	8 @11

STUDIES FOR THE AGRICULTURAL AND MECHANICAL COLLEGE.

PREPARED FOR THE ANNUAL MEETING OF THE STATE BOARD OF AGRICULTURE, BY G. C. SWALLOW, PROFESSOR OF AGRICULTURE.

The farmer, like everybody else, needs a two-fold education, a physical and an intellectual.

Heretofore nearly all our schools have educated the intellect, and neglected the body. We have given the mind symmetry and power, and left the body to chance deformity and weakness. But schools should send out men: Physical symmetry and vigor is as important for the man as for his bullock; and it is as important for him to know how to hold the plow as it is for his horse to know how to pull it. We want physical as well as intellectual Apollos.

A man may know how grass should be cut, and not have the capacity to mow it. Some spend twice as much strength in mowing as others, and then not mow it as well. Every one should know how to work with ease, that he may not waste his vitality, induce premature decay, and shorten the span of life. Economy requires skill. Industrial education therefore should be two-fold.

1st. You must know what to do and how.

2d. Have the manual skill to do it.

The knowing how is the *science.*

The manual skill is the *art.*

To get the science we must study;

To get the skill we must work.

Our Industrial College then must be a school of labor as well as study.

How much labor and how much study is an important question.

The pupil must study until he knows what should be done, why it should, and how.

When this is accomplished, the intellectual division of an industrial education is finished.

The pupil must labor until he can do all farm work with skill.

When this is accomplished, the manual division of an industrial education is finished.

Whatever is more than this has no more place in an industrial school than in any other. It is not the idea of an industrial school to furnish a place for boys to work; but a place where they may learn to work.

If pupils would work more than is necessary to learn how, let them take their places as regular hands and receive their wages. But there should not be work enough to interfere with the necessary study hours; for study is the most important thing in Industrial as well as other schools.

But what shall the pupils do?

Everything that is done on the farm. Feed stock, groom and harness horses, castrate pigs, build hen coops, weed the onions, plough the corn, make fences, transplant trees, prune and graft and bud; make sugar, cider, wine, etc., etc.

Who shall direct this work? The professor. He who says what is to be done, why it should be done, and how, is the one to see that it is done, and well done.

Then the teaching and the practice will agree, science and art go hand in hand. This will prevent the introduction of many useless and impracticable theories.

When one teaches merely, he can advance many beautiful theories for others to practice, but when he is expected to carry out his own suggestions, he may be more cautious, take more care that his instructions will bear the test of actual experiment.

It will also secure the agreement so necessary, between the teaching and the practice.

The pupil should be taught what will be most useful on the farm and in the workshop.

But his education should not be confined to these matters only. The farmer and mechanic should have a good general education, that they may act well their parts in public life, and be fitted to become our rulers and legislators.

Let them feel themselves the full peers of the learned professions. Let farming become a learned profession.

A certain amount of preliminary knowledge is necessary, that he may understand the subjects which most demand his careful investigation.

Neither soils, nor plants, nor domestic animals can be fully understood without the sciences.

With these views we propose the following studies:

CHEMISTRY

First of all, as the foundation of all accurate knowledge practical. There is nothing that challenges the investigation of the industrial man, that can be fully understood without it. Soils, plants, animals, paints, dyes, fertilizers—all food, all nature, are founded on chemical principles.

BOTANY.

Next to chemistry, for practical utility, I would place the physiology of vegetables. Without it we can have no accurate knowledge of what culture is best for various crops and fruits.

The structure of plants,
the food of plants,
how plants feed,
and how plants grow,
should be known to the farmer.

NATURAL HISTORY.

Very high in the rank of studies I would place the Anatomy, Physiology and Hygiene of man and his domestic animals. The farmer should know the structure and functions of every organ of all the animals and birds he raises.

VETERINARY SURGERY

Is absolutely necessary in this connection.

Many a noble animal is lost for want of a little accurate knowledge of this subject.

He also needs a knowledge of the Intellectual characteristics and propensities of animals to manage them well.

He who knows the spirit and disposition of the horse, can make him far more useful and safe.

ENTOMOLOGY

Should have a prominent place in the catalogue of studies. All will admit its importance.

MINERALOGY AND GEOLOGY

Must be made prominent as the basis of an accurate knowledge of all soils, their composition, physical structure and durability. Also of clays, sands, limes, marbles, granites, and all other building materials, and the location of all mines of coal and ores as well as of all marls, humic and other deposits useful for fertilizers.

CLIMATOLOGY.

All should study and understand the weather, its causes and changes.

The indication of conditions and changes, and the adaptation of climate to various crops and domestic animals and fruits, should be well understood.

Winds, storms, rain, snow, hail, mists and frosts, should be well studied as materially affecting the crops, fruits and domestic animals.

MECHANICAL PHILOSOPHY

Will be most useful in all Industrial Pursuits.

The farmer and mechanic at every turn uses the principles of this science.

Mechanical Powers, optics, acoustics, pneumatics, light, heat, electricity, have their every-day applications on the farm, and all that pertains to the physical nature of things is necessary to the Farmer and Mechanic.

ASTRONOMY IS NEEDED

To give a full knowledge of the Seasons.

Farmers and Shepherds cultivated Astronomy in ancient times as most useful in their callings.

MATHEMATICS,

Including Algebra, Geometry and Trigonometry, as applied to Mensuration and Surveying are highly necessary. The higher departments are useful in Astronomy and general Physics.

ENGLISH LANGUAGE AND LITERATURE

Must have a prominent place. A man's happiness and usefulness in life, and his intelligent hopes of heaven, depend upon his attainments in these studies.

Without them the farmer will be the peer of nobody but the illiterate; and the Industrial College will not elevate the profession much.

POLITICAL ECONOMY

Should certainly have a place, for, without thrift, no farmer need hope for success.

So much of learning I would require before giving a diploma.

There are other studies very useful to the farmer and mechanic, though not absolutely necessary for his success, which may be added as optional studies.

Latin Language,
Moral Philosophy,
International Law,
French Language,
German Language,
Book Keeping and Drawing.

With a tolerable knowledge of Latin a pupil will obtain a clear knowledge of the sciences necessary to the farmer much quicker; so much so, that the study of Latin could be an economy in time, to say nothing of the other advantages.

Latin is the language of science. With it, we can read the scientific works of all languages, but without it, we cannot read intelligently the scientific works of any language.

MORAL PHILOSOPHY

May not be so necessary for a farmer. He communes with nature so much that his moral powers are better developed.

Few crimes are perpetrated by farmers.

FRENCH AND GERMAN

Are generally useful, especially to the farmer and mechanic, as they are the repositories of vast stores of agricultural and mechanical knowledge.

Book-keeping should be understood, that farm and shop accounts may be kept regularly and accurately.

AGRICULTURAL TECHNOLOGY.

Under this head I would include all the practical pursuits of the farm and the workshop.

It is absolutely necessary the student be taught how each department of farming* should be managed, and how each particular thing should be done.

The *uses and adaptations* of farm houses and farm buildings.

The comfort and health and consequent thrift of men and all domestic animals depend very much upon the manner they are housed.

Fences, whether of stone, wood, earth, or living plants, should be well understood.

Fences are the one most expensive item in farming. Economy and thrift in this is necessary to good farming.

The division of the farm into forests, pastures, meadows, fields, orchards, vineyards, gardens, nurseries, and lawns and shrubberies, is a matter of great importance to comfortable and successful farming and should be well understood.

FORESTS, THEIR IMPORTANCE AND MANAGEMENT.

Our forests are disappearing too fast for the future prospects of the country. It requires a generation to grow a forest. Each generation therefore should provide the fuel and timber for the next.

Pastures, how to make and keep in the best possible condition. Good pastures make fat cattle.

One acre well kept, is worth five covered with bushes and weeds, the grasses but half set and half choked out.

Meadows. The soils of, whether wet or dry, sandy, clayey, calcareous, deep or shallow, how prepared and what grasses ought to be used.

Hay is cheaper than grain and quite as healthful for general use.

Fields. How divided. Exposure and soils to suit crops.

A happy division of fields enables the farmer to utilize the gleanings of every harvest and consume the grass of broken places and fence rows.

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*In technology we here include only what pertains to the farm and omitted what should belong to the workshop of the mechanic.

ORCHARDS—SIZE, EXPOSURE, SOIL.

What fruit and how much of each, preparation of soil and fences.

Peculiar culture and management of each kind of fruit.

Nothing gives better returns for good care, than fruit.

Nurseries, to show the modes of culture should be maintained on a small scale.

Vineyards should have the most careful attention. Their location, exposure, preparation of soil and fences, and supports for vines, varieties of vines, when and how planted and managed from year to year.

Missouri above all other States, should perfect this branch of rural industry.

Gardens, size, location, soil. Divisions for vegetables and small fruits, the culture and management of each.

Flower Garden must have a place by each home, if but one flower be cultivated. One lily or one bright-eyed pansy, is a fountain of sweet pleasures.

Lawns and Shrubberies should be well studied in connection with

LANDSCAPE GARDENING.

He can work better and sleep better, who has well-kept lawns and beautiful perspectives. They are pleasant things to have and more pleasant to understand.

The more attractive home is, the less will its possessors seek their pleasures away from it.

A BOTANIC GARDEN

is absolutely necessary to the success of an Agricultural School. Living plants from all climes and from all classes, are needed to illustrate vegetable structure, the food of plants, and their useful qualities.

The Conservatory, Hot House, Forcing House Pits and Hot Beds are absolutely required to give a full knowledge of propagating fruits and other plants and raising vegetables and ornamental plants for market and use.

Propagation of Trees and Plants, including grafting, budding, layering and transplanting, must have a place.

Pruning and *Training* are highly important and least understood.

Farm Architecture, including Farm Houses and Out Buildings, Bridges, Fences, etc.

SUPPLIES OF WATER,

Wells, cisterns, springs and ponds;
How constructed and managed;
Machinery for raising and conveying water.

FARM CROPS—

What should be cultivated.
Management of each.

FARM MACHINERY.

Structure and management.

FARM TOOLS,

How to make and repair the same.

ROADS, WALKS, AND PATHS,

Should have particular attention. How to lay out and construct the same.

A road well made is durable and economical; but one badly made is worse than a natural road.

We are beginning to lose money by making poor roads; we formerly lost it by making none.

The manufacture of lime, cements, brick, tiles, cider, wine, vinegar, sugar, etc., should receive particular attention.

Timber, different kinds of wood, and the uses of each, where it grows, when to cut and prepare for market and for home use.

DOMESTIC ANIMALS

Should be the special study of the student of Agriculture.
What the use of each?
What breeds are the best for each particular purpose?
What are the good points of each species of domestic animal?
What the good points in each breed?
What are the laws of breeding?
How to develop any particular quality?
The best methods of growing each species and breed?
How to fatten and prepare for sale or use?
Are questions that every farmer should be able to answer.

BEE CULTURE.

SOILS

Should be thoroughly understood in their origin and uses.
Their Composition and
their Physical structure;
what ingredients are necessary;
what physical structure to make them warm and dry and wet and cold.

Their adaptation to particular crops, and what ingredients are necessary for each.

How change composition to suit any particular crop.

How supply what has been exhausted.

What the various crops take from the soil.

What exhausts the most.

PHYSICAL STRUCTURE OF SOILS,

How changed.

What the advantages of light, dry, warm, heavy, wet and cold soils.

What causes each variety.

How can each quality be increased or diminished.

What the best condition to absorb moisture and gases, and the heat of the sun.

What condition best for digesting plant food.

SUBSOILS,

Their composition and structure, impervious or porous.

Fitness to recuperate the soil when exhausted.

CLASSIFICATIONS OF SOILS.

RELATIONS OF SOILS TO CROPS.

MANURES AND FERTILIZERS

Should be well studied; as Stable Manures, Night Soils, Marls, Humic Deposits, Peat, Limes, Sands, Clays, Turfs and Composts, etc.

Exhausted soils should be examined, to learn by what and how to recuperate them.

Whether by Subsoiling,
by Green Manures,
by Stable Manures,
by Composts, or
by Special Fertilizers.

UNDERDRAINING.

Best modes and when needed.

Each student shall have the care, under the Farm Superintendent, of some part of the work for one week or more. During this time he shall give strict attention to the matter, keep a daily journal of all his operations, and at the close make out a full report of the same.

To illustrate—he has the care of the horses this week. It shall be his duty to see that the stable is kept in order, the horses properly fed and groomed, that they are correctly geared and properly handled, and worked in a skillful manner.

He shall keep an account of all food given to each animal, the work done by each, his condition when received, and at the end of the week. How much was gained or how much was lost.

During this week, it shall be his duty to give his time to the study of the horse, reading such books as the Professor may direct.

At the end of the time, he must hand in to be placed in the Farm library a dissertation on the horse, also a copy of his diary for the time he has the care of the horses. These Journals will form a complete history of the farm, open to all students.

LENGTH OF THE COLLEGE COURSE.

In the Agricultural, as well as all other colleges, there will be students who cannot spend time enough to complete a full course of study; and, besides, it is a tendency of the times to give as little time to education as possible.

The course of study should be arranged to meet, as well as may be without injury, these conditions of things.

If we require a preliminary preparation of reading, spelling, arithmetic, geography, English grammar and composition, a three years' course may do best, for which a diploma shall be granted for the degree of B. A. A.

There should be a higher course in Language and Literature and Science, for a more thorough acquaintance with the higher departments of Agriculture and Mechanics, to occupy one year. For this course give a diploma for the degree of M. A. A., or something equivalent.

Students in this higher course, may be made tutors and managers of particular departments of the farm and shops, with marked advantage to themselves and the institution.

For such students as desire a practical course, and those who desire the instruction in some particular department, as Horticulture, provision should be made, and a certificate of proficiency given.

It is not expected that all this will be accomplished at once. It will require time and means to perfect an Agricultural College. Such schools are new in this country. Proper plans have not been fully perfected, and there are popular prejudices to be overcome and corrected, and means to be accumulated.

It should be our first object to establish a proper course of study, and obtain all the necessary apparatus and teachers to give the best possible instruction in that course.

After this, or at the same time, the Farm should be put in perfect working order, as fast as the means are accumulated. But as we have little or no means to work with at present, some of the less expensive departments, and those most useful for technical or practical instruction, should be put in order, such as the vineyard, garden and orchard.

The department of *Technology*, or *Practical Instruction*, should be arranged and perfected as far as the progress of the farm and its appliances will permit, that the students may have its practical advantages as fast as possible.

STUDENTS IN THE AGRICULTURAL COLLEGE, THEIR STUDIES AND PROGRESS.

BY G. C. SWALLOW, PROFESSOR OF AGRICULTURE.

At the beginning of the present collegiate year, it was not generally known that we would be prepared to give instruction in Practical Agriculture; and students, who desired to take this course, had made other arrangements for the year. And besides, there was a general impression that they could learn but little at a school starting under such circumstances.

Still, quite a number have entered the class in *Practical Agriculture* or *Agricultural Technology.* The most of them have become very much interested in their studies, and the practical applications of the same in the orchard, vineyard and garden.

They have been as enthusiastic, studious and punctual in this as in any of the classes of the University.

All this has been accomplished notwithstanding the obvious difficulties under which we have labored.

In starting a new school, there is always more or less difficulty in getting the arrangements perfected, and everything in good working order. This difficulty was greatly increased in the attempt to start a school on principles comparatively new in our community.

There were prejudices deep and strong and outspoken on the part of the aged and influential as well as on the side of the young and inexperienced. These prejudices could not fail of having much influence over those entering or proposing to enter upon this new department of study, as well as over the teachers.

In other professional schools the course of studies has been well digested and perfected; so that the teacher and pupil have a beaten path well marked before them. But in the Agricultural School nothing has been long tried and well established in America at least; and the Agricultural schools of Europe were established to meet the wants of communities, whose relations are so different from our own, that their experience is of comparatively little value to us. We have been compelled to adapt ourselves as well as possible, with the few aids we have, to the circumstances surrounding us.

Good text-books have been prepared for all other departments of learning, by the best minds engaged in teaching those studies; but in this department no books have been published adapted to the wants of the class room. This deficit devolves much additional labor upon the teacher and pupil and is well calculated to discourage both.

But little apparatus has been prepared and adapted to the wants of the teacher of Agriculture, and we have been compelled to get along as best we could, without even that little.

Our farm too, is in no condition to give us the illustrations and practice so much needed. All is new, and we have but little means to improve with. We need orchards, nurseries, gardens, hot houses, propagating houses, pits, frames, domestic animals, and farm implements and farm machinery. What few illustrations and little practice we have had, save in one or two items, were given by the neighboring orchards, gardens and lawns, and the courtesy of their owners.

Buildings fully adapted to our wants are not yet completed. Though we are very well accommodated for a new school as we are, still a working labratory, lecture rooms, and cabinets of natural history and the varied materials of the farm, and apparatus, all suited to our wants, would enable us to make our instructions much more interesting and profitable.

But notwithstanding these and many other circumstances and facts, which have tended to render this beginning difficult and discouraging, our success has been far greater than we had reason to expect.

We have some encouraging facts. Many of our students are working their own way—paying their expenses by their own labor Those who manfully overcome the difficulties in such a course, and persevere unto the end, usually take their places among the leading men of the country.

In general, our students are manly, earnest and studious. They are such as give great promise of perseverance and success.

So far as the weather and the seasons would permit, out door working lectures have been given in illustration and application of the principles taught in the lecture room. Pruning, for example, in nearly all its departments, has been thus taught. Each student could prune his tree or vine, according to the principles taught, give his reason for what he had done, and submit his work to the criticism of the class and the examination of his teacher.

In these, and similar working lectures, all have been much interested and greatly benefited.

Twenty-five students have entered this class in Practical Agriculture, and some eight or ten others have attended irregularly, as an extra study, when their lessons would permit, especially the out door working lectures, in which all have borne an active part.

The members of this class, and many other students are pursuing the various studies of the agricultural course, such as Botany, Geology, Chemistry, Mathematics, Natural History, English Literature, etc., etc.

In short, full as much is being done, and as many students are entering upon the studies of the Industrial College as we had any reason to expect at so early a stage of its progress. It has been but little more than half a year since the location was finally settled in this place, and yet we have a good school in full operation, and a good number of enthusiastic, hopeful students. Some of them are practical farmers, fresh from their labors. They have discovered they can learn something about farming at school.

WHAT HAVE THE PEOPLE OF THE STATE A RIGHT TO EXPECT OF THE STATE BOARD OF AGRICULTURE, ETC.

BY T. R. ALLEN, OF ALLENTON, MO.

[*Read at the Annual Meeting of the Board.*]

Mr. President and Gentlemen of the Missouri State Board of Agriculture and Brother Farmers:

I find the subject assigned me for discussion at this meeting to read as follows: "What do the people of the State expect the State Board of Agriculture to accomplish with their present means?" I will take the liberty of changing the phraseology so as to make my subject read: What have the people of the State a right to expect the State Board of Agriculture to accomplish with their present means?

As the question stood at first, it would be somewhat embarrassing to define what the people do expect, but as it now stands, it has quite another meaning, and is more tangible in form. Being myself one of the people, and having been one of the committee of three appointed by the Meramec Agricultural Society, in August, 1860, to take the initial step toward the creation of this State Board of Agriculture, and ever an interested observer of its progress, I think I may, without being liable to the charge of egotism, claim to know something not only of its objects, but of what the people of the State have a right to expect from this Board.

First, then, I would say that the people have a right to expect it to fulfil the purpose of its creation.

Then, the purpose being the improvement of agriculture and the elevating of the agricultural classes to their true position in the scale of the industrial pursuits: First, by taking measures to ascertain their real condition at present; secondly, by taking the necessary measures to remedy present defects, collecting and tabulating statistical information, and then disseminating it among the people in tabulated form.

The fact that the average standard of education among the agricultural classes is low, is not to be disguised. We could not disguise it if we would, and would not if we could. I have little hope of any great improvement in the modes of agriculture until those engaged in it become more intelligent. While that absurd idea prevails that but little education, or none at all, is necessary for a farmer, there can be little hope of improvement. No pursuit in the whole range of human society requires so extensive, so thorough and so diversified knowledge of the natural sciences as that of the agriculturist. And yet the mass of the farmers don't believe this, and this is the worst feature in the whole case. Then, it is evident, that before we can make any real and substantial progress, this obstacle must be removed. A general knowledge of the *want* of knowledge, is the first great desideratum. The best way to bring this about may be a matter of speculation. Some will learn it by precept, while others will only learn by example. And many require both, while some will not learn at all. Many men, though so full of old fogyism that they would ridicule the idea that any body knew more about farming than they, their father, and grandfather, and great grandfather did, are still very ambitious to excel, and are also very sensitive in a certain nerve called the pocket-nerve, and though they know nothing of what is called science, and so believe nothing of it, yet with them seeing is believing; and when they see that you can raise more corn or wheat per acre, or can make a fatter and heavier hog on a less amount of food than they can, they are very apt to begin to inquire *within* for the cause. A man must be convinced of a want of knowledge before you can induce him to seek it. Therefore, in my view, it is the duty of this Board, first of all, to take measures to make this want known, and then to make provision to supply it.

I think we have a right to expect this. This foundation being securely laid, the superstructure will gradually rise, very slowly it may be at first, but surely, and it remains only a question of time, and it may be a brief one, when this bold and mighty structure will begin to loom up in such proportions as to attract the notice and command the respect of all the world and the "rest of mankind." Then, and not till then, will the agricultural classes be placed in their normal and true position. Then, and not till then, will farmers cease to cut each other's throats, by suffering themselves to be divided up into sections, and arrayed against each other under the leadership of antagonistic political demagogues, who will, each in turn, damn them with faint praise while seeking their votes, and after they get them, damn them by a total neglect of agricultural interests. Think ye, gentlemen, that if the agriculturists were educated up to the standard of their true position, that it would be a crime in the eyes of petty politicians for you to introduce for discussion in your body, subjects of political economy, affecting the interest of agriculture? And that for so doing, the threat of "wiping out" hangs over your heads. I read the reported discussion had on certain resolutions introduced in your body on the 2d day of December last, with mingled feelings of surprise, pity and contempt. If the agriculturists of this country have not a clear and indefeasible right to discuss questions of political economy—not party politics—which vitally affects their interests as agriculturists, in the name of all the gods at once, who under the canopy of Heaven has?

The trouble with farmers is, that there is not that unity of feeling and purpose, and concert of action, that is found in other industrial pursuits. Politicians know this and take advantage of it. While they possess all the elements of governing power in this land, numeri cally and otherwise, in their present unorganized condition they are utterly powerless, not only to procure legislation promotive of their own interest, but to resist such as are antagonistic to them. While this is the case, they must inevitably remain the "hewers of wood and drawers of water" for the rest of mankind. Must we remain in this condition? Is there no remedy for this state of things, gentlemen? We maintain that there is a remedy, and that the remedy is to be found in the better education of our people, and that this education is not to be left exclusively to our agricultural colleges, however valuable they may be as helps in this great work. If these are left unaided by other influences, many more generations must pass away before the work is accomplished. A member of your Board, in the discussion above alluded to, propounds the following question, and furnishes the answer himself: "Why and for what purpose was this Board organized? The answer is found in the name of our organization: 'The State Board of Agriculture.' We were organized to promote the interests of agriculture, to collect and disseminate information relative to the improvement and progress of agriculture everywhere; to improve our stock, to gain reliable information respecting rare reported improved breeds of domestic animals; how to treat and handle them so as to make this branch profitable; and to give information where valuable breeds can be had; to introduce new seeds and plants into the State, and disseminate information as to use and culture; and, moreover, to examine minutely all agricultural machines, and improvements claimed on the same, and embody the results of our investigations in our annual report for the benefit of our farmers. This I contend was the sole and exclusive object for which our Board was organized, and topics relative to these are the only ones to be considered by us."

And *where* in the "*bond*" does our friend find all this? Just this, and nothing more?

But whether to be found in the bond or not, it might all do well enough except "the sole and exclusive." To this I enter my solemn protest. Are animals, whether "valuable breeds" or not, or "new seeds and plants" and their culture, and machines, of more value than men and their culture? Mind governs in this age of the world. Cultivate men and the improved animals, seeds, plants and machines will follow as a natural consequence. But our friend lays great stress on "our annual report for the benefit of our farmers." Well, it is true, you have gotten up some valuable reports, but how many farmers read them? There are only six thousand printed, probably about one for every forty or fifty families in the rural districts. So, also, this alone would be a slow process of education, though a valuable help. No, gentlemen, if we ever accomplish anything in this matter, we must go back to first principles; we must institute a missionary enterprise that will reach every farmer in the State; visit them at their homes, by their firesides and on their farms; collect them at their school houses and talk to them earnestly and fervently; organize a "Farmers' Club" in every school district in the State.

These are the schools for farmers—their primary schools—let these form county clubs, or societies, if you like that name better, and let all these be represented in your Board. By getting the farmers into these clubs you set them *thinking* as they never thought before; this induces a desire for reading good agricultural books and papers instead of the venal, frothy, *political party* papers, the greater portion of which are mere trash, to say the very least of them. This, gentlemen, we think we have a *right* to expect from you. You will then be justly entitled to the gratitude not only of every farmer but of every true patriot in the land.

But I must not forget the latter clause of my text—"*with their present means.*" See how thoughtful your committee! I take it for granted that the term *means* here, means money. This was well put in; but it will compel me to pay my respect to the honorables again. That the laborer is worthy of his hire, is as true as trite. I believe in paying well—that is, justly. Good service should be justly rewarded. But how much money have you at your disposal for the accomplishment of this great work? By referring to "an act for the encouragement of agriculture," I find that the *liberal* sum of *one hundred dollars* was appropriated to put this Board into operation. Since that, an additional annual appropriation of five thousand dollars has been made, after much humble praying and beseeching of course. And I see that your treasurer last year suggested the propriety of praying to the Honorables for another additional thousand, but I am not aware whether you prayed, or how much you prayed, or whether all your prayers were successful or not.

What miserable mockery is here exhibited: Our State, being almost exclusively agricultural, for hitherto our great mineral resources have scarcely been touched. Five thousand one hundred dollars annually for the encouragement of agriculture in the State of Missouri? Shall this be told in Gath, or published in the streets of Askelon, in the latter part of the nineteenth century. And how do you use this *liberal* appropriation? You divide it among three men—the Entomologist and your two Secretaries—and they are not overpaid. Then what remuneration have you gentlemen for your time, labor and skill devoted to this great work? Nothing—absolutely nothing. Truly, gentlemen, yours must be a labor of love. However we may admire the character of the voluntary philanthropist, when onerous duties are imposed and a faithful performance required, we believe the *quid pro quo* is only reasonable. The fact, is, gentlemen, if your services are worth having they are worth paying for, and the farmers are willing they should be. Not only should you be remunerated for your services, but a fund should be placed at your disposal commensurate with the great duty with which you are charged. Let good and true, experienced and practical men be selected, let them be suitably remunerated, and held to a rigid accountability for faithful performance.

This most ancient and most sacred occupation of man, on which all others are dependent, is the one most neglected, overlooked, abused and imposed upon, and, *worst of all, with the seemingly tacit consent of the farmers themselves.* Uncomplaining and patient as the ox, they seem to labor and toil on in the drudgery of mankind, submitting to every species of imposition and oppression that the more disingenuous and crafty choose to put upon them.

Then, the "present means" question, in connection with the present surrounding circumstances, becomes one of much greater importance than at first glance might appear. A labor of love, to some extent, at least, becomes absolutely necessary. The paramount general good absolutely requires that this abnormal state of the agricultural community be removed, and the true normal condition be restored.

The question now arises, how can this be done? To my mind the missionary plan is the only feasible one. But this requires means or money. You cannot reasonably expect to find men who will devote their time, energies and labor to this purpose without the wherewithal to sustain them in their work. You have, we will say, five thousand one hundred dollars of an annual appropriation; it is true that even this pittance is contingent on the caprice of the Honorables—our noble masters at Jefferson City—perhaps, by much humble praying and beseeching upon bended knee, this amount may be retained. Predicating then upon this, instead of keeping your Corresponding Secretary here in this office, laboring all the year to collect statistical information, and preparing an elaborate report, which so few see or read, let him take the missionary field, visit and talk to the farmers privately and publicly, organize them into clubs and county societies, and induce them to read agricultural books and papers. In this way farmers will not only be lead to know each other, but their true relative importance to the rest of mankind; then, and not until then will farmers take their true position.

Let the annual appropriation be chiefly used for this purpose; let the annual report appear, of course, but let that be subordinate to this great missionary work; let all other considerations bend to the inauguration of this system, and my word for it, gentlemen, not many years will elapse until a mighty revolution will have been achieved in this country; the occupation of rings of political conspirators will have departed; land grabbers, speculators on the ignorance and cupidity of farmers, railroad monopolies, banking monopolies, express monopolies, and monopolies of every other description, will not only cease to fatten and prosper on our hard earnings, but be driven to honest labor for their subsistence. The sturdy agriculturist will then no longer be subjected to the humiliating process of going on their knees in supplication to the so-called Honorables for a mere pittance of their own money for the encouragement of their noble calling

But on the contrary, agriculturists will find themselves masters of the situation; a simple hint from them then will secure infinitely more than all their prayers and supplications will at present; more humane and praiseworthy laws will be enacted, and they will be more honestly and faithfully executed.

Then, gentlemen, with even your "present means," we claim that we have a right to expect you to put this missionary system into operation forthwith, so as to educate the agricultural classes up to a knowledge of their real importance, power, and true position in this land of ours.

A DOG LAW.

READ BEFORE THE STATE BOARD OF AGRICULTURE BY G. W. KINNEY.

Mr. President: In considering the subject of a dog law, I do not propose to make a lengthy paper upon the subject, but to throw out such thoughts and views as have been suggested by my own experience and in my limited observation among farmers.

The subject is not of my own choosing, and I might have let the matter pass without offering any thoughts, feeling that I should have been in the fashion, to some extent, with some of the members of this body, were it not a principle of my own, long since settled upon, to endeavor in whatever position I am placed as a member of this Board to do the best I can to promote the objects of our Association and the interests of the farmer.

If I shall draw out or provoke a discussion by what I shall here offer, which shall result in the passage of a dog law, by which the number of worthless curs may be decreased, the expense of their maintainance saved, and the flocks of the wool grower protected, I shall feel that I have accomplished much, and that the object for which these subjects were assigned to these several committees will in some measure have been attained, and that the money invested by the State in supporting this Board has not been entirely thrown away.

I shall not detain you with a history of the canine species, nor attempt to show whether they are descended from the wolf, the fox, or the jackal; or whether they were originally dogs and nothing else. It is enough for us to know that as the companion of man they are found under all circumstances of human existence.

Neither shall I introduce anecdotes proving the sagacity, faithfulness, affection, gratitude, courage and other useful qualities of the dog. These have been known from remote antiquity, and perhaps there are those present who may wish to enlarge upon these points; at least he can find plenty of friends ready to defend him against any charges that may be brought against him.

I do not claim to be a special friend of these creatures, and it would be easier for me to write an indictment against them, than to sing their praise.

I have been quite extensively engaged in sheep husbandry, and have been made to feel the damage which they are to the people and the State, which perhaps may account for my not being able to appreciate all their good qualities.

It is true that a good dog, like any other good thing, is worth having, especially when your neighbor has mean hogs, and he is mean enough to let them run in the road. But we are in hopes of having a stock law that will compel every man to feed his own stock and not live sponging upon others; then one good quality of the dog will be useless.

This matter was discussed before the St. Louis Farmers' Club, and several gentlemen told how to prevent dogs killing sheep—such as having a number of bells, letting them run with cattle, etc. These may be of some little use, but I have tried them all, and besides have set up nights watching them, armed with a double-barrelled shot gun and a bottle of strychnine, and notwithstanding have lost many sheep by dogs. I do not think there is any way to effectually prevent dogs killing sheep, but believe the best way is to keep them well fed.

I have made an estimate of the number of dogs in the State of Missouri, and the cost of keeping the same.

To a person that has not stopped to reflect and consider the subject, the statement which I am about to make will appear astounding.

It is to be regretted that the government, in taking the census, did not enumerate the dogs; but in the absence of anything definite upon this point, I shall have to rely upon an estimate. If I have been mistaken in my judgment, I hope some one will correct me, because it is facts which we desire to have in this connection.

The total population of Missouri, in round numbers is 1,600,000. Allowing seven persons on the average to compose a family,* would give us 230,000 families, and allowing two dogs to each family, which I am certain is less than the actual number in the country, would give us 460,000 dogs. The amount of food necessary to support a fair sized dog—and if it not fed to him he will steal it—will keep in good thriving condition one hog, that at twelve months will weigh 200 pounds, or for the whole number of dogs, 92,000,000 pounds, or 46,000 tons of pork, which if loaded into cars, at 10 ton to the car, would make 4,600 car load, and if sold at six cents per pound, would amount to $5,520,000, which is nearly twice the value of all the school houses in the State, and more than twice the amount raised by all the townships in the State for school purposes in the year 1869.

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* As a rule in social science, five persons compose an average family.—EDITOR.

To be certain that I have not over-estimated the number of dogs, I quote from the *Journal of Agriculture*, October 27th, 1870, where the editor, in speaking of Cedar county, says: "Scarcely a house can be found where from two to four dogs are not kept."

This is about the average in my vicinity, and *it is not a healthy place for dogs either!*

About three years since one of my neighbors was forced to sell his farm—whisky and keeping "dog hotel" had made him bankrupt. The purchaser moved to the place before he left, and as he was moving away, he said to the purchaser one night: "I believe I have got everything but my dogs. I would like to leave them in your charge, and will come after them in the morning."

"All right," said the purchaser, "have you taken an inventory of them?"

"Yes, yes: there is thirteen of them now, but that old slut will have pups before I get back."

Thousands in this State are as rich in dogs as he was, while scarcely a family that has not at least one.

To the expense of feeding dogs must be added the value of sheep and other domestic animals injured and destroyed by dogs, and we find the amount soon footing up to enough to pay the entire State debt in a short time.

But just the money value of the domestic animals injured and destroyed, is not all the damage. The excitement, the watchfulness, the worry and care which the owner of a flock of sheep must undergo, cannot be measured by dollars and cents; besides a great many disputes, quarrels and feuds arise among neighbors from this cause, and even human life has been sacrificed.

By referring to statistics furnished by the Department of Agriculture, we find that a partial enumeration of the sheep killed the past year in the United States, by dogs, as returned from four hundred and seventeen counties, aggregating 99,387, points to a loss of a half a million sheep killed and as many more wounded by dogs, involving an actual loss of two million dollars, and a constructive and none the less real loss to production of many millions more. Millions of dollars' worth of rich grasses and other vegetation annually go to waste in the open and grassy forests, and in the old fields and waste places of the South, because there are no sheep to feed upon them; and the reason why sheep are not thus utilizing this spontaneous production is, the presence of dogs.

The following notes are but samples of complaints coming up from every quarter of the land:

Essex County, New Jersey.—No sheep kept merely for fleeces, on account of dogs.

King George, Virginia.—More than half the flocks destroyed by dogs this winter.

Greenville, South Carolina.—Dogs increasing faster than sheep; wool-growers are slaves to dogs.

Sumter, South Carolina.—Thirty sheep killed by dogs in one night.

Yazoo, Mississippi.—Half the sheep have been killed by dogs.

Wilkinson, Mississippi.—At one time, twenty-three killed.

Lincoln, Kentucky.—Dogs are a serious drawback to wool-growing. Our legislators have been importuned, time and again, to give protection, but they have turned a deaf ear to our appeal.

Rush, Indiana.—The slaughter is severe in every township.

Ripley, Indiana.—Sheep do well when not molested by dogs.

Warren, Indiana.—Large numbers killed by dogs.

Parke, Indiana.—The loss has been ten per cent. by dogs last winter.

Fayette, Ohio.—No losses except from dogs.

Morgan, Illinois.—Selling off for mutton, on account of dogs.

Edwards, Illinois.—Our correspondent lost sixty fine grade South Downs killed by dogs, and many injured.

Scott, Illinois.—Dogs destroy more than all diseases.

Scott, Missouri.—Sheep could be profitably kept but for dogs. *Many persons think the United States Government should levy a tax on dogs.*

Iowa County, Iowa.—There is no disease but the dog disease.

Rusk, Texas.—No disease among sheep, but great loss from dogs killing them at night; and, unless dogs are restrained from running at large, as they do here, sheep will become extinct in the county.

Similar notes could be multiplied indefinitely. While the reduction of taxation is the tendency of the times, a tax by the General Government upon dogs, like that of British and European governments, would prove a hundred-fold more benefit than hardship, relieving the poor of the great burden of keeping them, and society of the intolerable nuisance of worthless dogs, at the same time improving the animals worth the value of a tax, and taking from the industry of wool-growing one of its greatest burdens of taxation.

In 32 counties of Missouri there was last year reported 10,602 sheep killed by dogs, and this report is based upon estimates which I am sure are much below the real number.

Besides these damages we must take into account the number of persons bitten by dogs, and the number of deaths from that appalling disease Hydrophobia, which by the census of 1860 was upwards of 50 persons annually. Last summer there were over 50 deaths in St. Louis alone.

But to offset against this debtor account charged to the dogs, they should have some little credit. They are said to be good to keep off the "varmints" in a new country.

The shepherd dog is of great value to the shepherd and the drover; another makes a good watch dog; others are death on rats, etc.

Let us now look and see what kind of laws they have thought proper to make on the subject elsewhere.

In New York, if one's dog chases or worries cattle, an action lies against the owner, if he have notice that his dog is in the habit of doing this.

But no one has a right to kill the dog except he worries sheep; to justify killing him, except in the case of sheep, it is necessary to show that he could not otherwise be separated. If he attack a person, or actually kills any domestic animal, he may be killed.

In Massachusetts, the statutes provide that any person may kill any dog that is going at large without a collar; and the courts have decided that "going at large" means, if he be loose, and is out of the enclosure of the owner, although he is under his immediate care.

Double damages may be recovered for an injury done by a dog. There is also a penalty of $10 for allowing a dog to run at large without a collar and without a license, and a further penalty of $10 if any dog should wear a collar without a license.

In Maryland, if any dog be detected in killing or injuring sheep, and the same shall be proven by oath or affirmation of any person, the owner shall proceed forthwith to kill such dog, and if he refuse or neglect so to do, the owner of the sheep injured may do so, or he may produce the affidavit to a constable, and he shall proceed forthwith to the house of the owner of such dog and kill such dog there or wherever else found, and for the discharge of his duties here imposed he shall be entitled to receive the sum of four dollars for every dog so killed, to be paid by the owner of the dog, and to be collected the same as other constable fees are collected. If the owner of such dog refuse or neglect to kill him, he shall pay double damages to the owner of the sheep killed or injured. By the law of 1831, sheep are exempt from taxation.

In Wisconsin, any person may kill any dog that shall suddenly assault him while he is peaceably walking, riding or being anywhere out of the inclosure of the owner or keeper of such dog.

If any dog be found killing, wounding or worrying any sheep or lambs, it shall be lawful for any person to kill such dog at any time before he shall have returned to the enclosure or immediate care of the owner thereof. The owner or keeper of any such dog shall be liable to the owner or keeper of such sheep, for all damages done by such dog, without notice to the owner, or knowledge by him, that his dog was mischievous, or disposed to worry or kill sheep. After knowledge or notice that a dog is mischievous, the owner shall be liable in double damages.

If such dog injure any person, the owner thereof shall be liable in triple damages for all injuries of any kind, ever thereafter done by such dog.

Pennsylvania has special laws for different counties in the State, of which the following is a specimen: Pike county.—The assessor shall annually, when taking the names of the taxable inhabitants, take an accurate account of all dogs upwards of one month of age, owned or kept by every person, noting the number kept by any one house, and shall furnish such account to the auditor; whereupon the auditor shall levy and cause to be collected from every person owning or keeping one dog, one dollar; from every person keeping two or more dogs, one dollar on one dog, two dollars on the second dog, three dollars on the third dog, and so on, increasing in like ratio; which tax shall be paid to the township clerk, who is hereby constituted the treasurer of the township sheep fund. Any person having sheep killed or injured by dogs, shall apply to the trustees of the township, who are hereby appointed appraisers, and they shall appraise the damage done by dogs to the sheep, which damage shall be paid out of the sheep fund. If at the expiration of any fiscal year there shall remain in the treasury $50, or more belonging to the sheep fund, it shall go to the public school fund of the township.

Every dog kept or staying about any house, shall be deemed sufficient evidence of ownership by the person inhabiting said house; and any person sending his dog away, or refusing to return him to the assessor, shall pay double tax.

[The essayist further quotes at length from the laws of Virginia, Michigan, Iowa, Illinois, Vermont and Indiana, in all of which States laws have been enacted in favor of sheep-husbandry as against dog-husbandry. Want of space alone have decided the president to order that these carefully prepared laws be omitted here.]

These are sufficient to show us how they legislate on the dog question in other States. But here in "Free Missouri" there is no statute law on the subject, and if you should make a law of your own to suit the occassion, and kill the dog caught on your premises in the very act of killing sheep, the chances are that his owner might retaliate by shooting you.

The principles of many of our laws and customs work a hardship upon the community, and this one, virtually offering a bounty upon worthless dogs, exempting them from taxation while everything else is taxed, is one of them. Where we have no statute law applicable the common law applies. At common law the gist of an action against the owner of a mischievous animal lays in the keeping of such animal after knowledge of such propensities. Under such a construction there is virtually no protection to the owner of sheep. If your dogs kill 50 sheep for me in one night, it compels me to prove that you know he was guilty of such tricks before I can recover any damages for them. Whereas the principle should be changed and instead of making the wool-grower protect his sheep against the whole community of dogs—as we now have to protect our crops against the whole community of stock—it should compel every man to take care of his dog and to let my sheep alone, or else pay all damages that may arise from their running at large or from their mischievous propensities.

As it now is you might with as much propriety say that unless I keep my purse in a strong vault, or my doors and windows barred or barricaded, that it should be no crime to steal or to commit a burglary. If people wish to indulge in the luxury of a half dozen or more of dogs, I would not prohibit them, but let them do so at their own expense—let them feed them and keep them under control, and if they do not, make them as responsible for their crimes as they would be for their own. I have heard it said that no law taxing dogs could be framed in this State except in violation of the Constitution. I suppose that reference is here made to the XXX section of the declaration of rights which says:

"That all property subject to taxation ought to be taxed in proportion to its value," and as dogs are of no value they are not property. But if we cannot reach them by a direct tax we can do so by a license law for the privilege of keeping a nuisance.

COUNTY REPORTS.

BOLLINGER.

C. W. Murtfeldt, Corresponding Secretary Board of Agriculture:

Bollinger county is situated in the southeastern portion of the State. It is bounded on the north by Perry county, on the south by Stoddard county, on the east by Cape Girardeau county, and on the west by Wayne and Madison counties. About one-half of the county is rolling upland, which is of a rich sandy loam well intermixed with clay, and is well adapted to grape culture. The bottom lands are principally gravelly, but are of a very rich soil and will grow any grain nearly as well as the Mississippi Valley.

This county is well supplied with water, being nearly all hard spring water. It has no river proper, but has two powerful streams running through it—namely, Crooked creek and Caster river; besides these there are numerous small streams which furnish an abundant supply of water throughout the whole year.

There are only four or five good water mills in this county, although there are many good sites for mills on both Crooked and Caster creeks.

The principal town is Marble Hill, which is situated on the St. Louis and Iron Mountain railroad, one hundred and thirty-three miles from St. Louis. Its population is about six hundred.

There is a large steam flour and saw mill, owned by Messrs. Whybark, Fisher & Molleneux, and a large stave factory, owned by Mr. John Brown, of St. Louis, in Marble Hill.

The population of this county, according to the census for this year, is 8,581, (eight thousand, five hundred and eighty-one.)

Timber is tolerably plenty throughout this county, the most of it being of good quality. The most abundant are white oak, black oak and hickory, while elm, sugar, gum, black and white walnut, linn, beech, mulberry, sycamore, white and blue ash, white and shellbark hickory, white maple, honey locust, willow, persimmon, dogwood, red bud, service berry, and wild cherry.

Of native wild fruits, we have an abundance of the following varieties, viz: wild cherry, wild plum, crab apple, black and red hawes, persimmon, service berry, blackberries, strawberries, gooseberries, raspberries, dewberries and whortleberries.

Of vines and shrubs we have the following varieties: Blue grape, bird grape, fox grape, and I have seen a few vines bearing a large grape resembling the Concord, (name unknown.) Also, sweet-briar roses, white and red roses, red and yellow honeysuckle, red bud, Indian arrow and sarsaparilla.

Land.—There is about one hundred thousand (?) acres of Government land in this county, most of it very poor land and fit for nothing but pastures. About one-eighth ($\frac{1}{8}$) of the land in this county is owned by non-residents. The average price of improved land varies from twenty-five (25) to fifty (50) dollars per acre, while unimproved lands sells at from five (5) to twenty five (25) dollars per acre, according to the location.

Minerals.—We have an ample supply of gray, white and blue limestone, gray granite and white and yellow sandstone. Coal has been found in small quantities, but not sufficient to amount to anything. Iron exists in large quantities, and if some enterprising man, with capital enough to erect furnaces, were to locate here, I think he would have a pretty permanent stand. Blossoms of lead have been found, which will probably lead to the discovery of large quantities of the ore, as it is supposed there is a large vein of it. There have been three or four large kaoline or porcelain clay mines discovered lately, which are being worked pretty constantly.

Mills.—There are three large flouring mills in this county; one large steam mill at Marble Hill, one water mill on Crooked creek, and one on Caster river.

There are as yet no foundries in this county.

Agricultural Implements.—Plows—homemade, so called diamond plows, are generally in use; but the cast plows are beginning to be noticed, and the demand for them is increasing daily. No subsoil plows have been tried as yet.

Cultivators.—There are several varieties of cultivators in use. The best is a patent hinge cultivator, made by A. J. Craig, and also a hinge harrow made by the same man.

We have no corn planters as far as I have noticed.

Reapers and Mowers.—We have in use the Buckeye and Kirby; they both work well, but the Kirby is most universally liked.

Threshing Machines.—We have one or two old machines, but none of much value.

Corn Shellers.—The principal kind of corn shellers in use are the hard but honest hands of the farmer. There are two or three patent corn shellers in this county, but I have not seen them.

There is no Agricultural Society. There has been a Horticultural Society started, but as yet has not amounted to anything of consequence.

The number of acres under cultivation in this county is about 39,078.

Wheat.—The average yield of wheat per acre is about twenty-five (25) bushels. The total amount of wheat raised in this county this year is about 8,000 bushels. Fall wheat is mostly cultivated. The ground intended for wheat is generally broken in July and August, then again in September to the depth of six (6) inches, then harrowed, sowed, and harrowed or plowed in. Wheat is hardly ever winter killed, for we generally have a mild winter.

Corn.—The average yield of corn per acre is about thirty-five (35) bushels. We have several varieties, namely, large yellow corn, white shoe peg, white gourd seed and white flint, and the best for stock is the large yellow corn. It is generally fed stock and all, being pulled off the stock and fed, and the stock fed at the same time. It is generally fed to hogs and cattle uncooked, as there is no steaming apparatus in use in this county. The average price of corn per bushel is from seventy-five (75) cents to one dollar ($1.) The amount of corn raised in this county this year is about 395,175 bushels.

Rye.—The average yield of rye per acre in this county is about eighteen (18) bushels. It is not used for anything but stock, and is not generally cultivated.

Oats.—The average yield of oats per acre is about thirty-five (35) bushels. We have four different varieties, namely, Black, White, Norway and Surprise oats. The number of bushels of oats raised in this county is 136,000 a year.

Barley is not much cultivated.

Buckwheat.—The average yield of buckwheat per acre is about thirty bushels. We have but one kind of buckwheat, namely, the black. It is not raised for stock, being all made into flour.

Sweet Potatoes.—The average yield of sweet potatoes per acre is about two hundred (200) bushels. We have four different varieties of sweet potatoes, viz: The Red, Yellow and White Yam, and the Yellow Nansemond. We do not feed them to stock, but use them largely for culinary purposes. The amount raised annually is about five thousand nine hundred (5,900) bushels.

Irish Potatoes.—The average yield of Irish potatoes per acre is about one hundred and fifty bushels. We have five (5) different varieties of "Murphies," to wit: The Buckeye, Peachblow, Neshannock, Pinkeye, and London Lady. The Peachblow is generally considered the best. They are not used for stock, but are used largely as a staple of food. The aggregate amount of Irish potatoes raised last year was twenty-one thousand three hundred and thirty (21,330) bushels.

Sorghum.—Of sorghum we have the black and red top varieties. It grows to a greater height and is said to contain more sap than the Imphee. There is several cast mills in use in this county, but the principal kind are the old-fashioned wooden rolling mills.

The yield of syrup per acre is about one hundred and fifty (150) gallons. The amount of seed averages about forty (40) bushels per acre, and is used for feed in preference to oats. To the best of my knowledge no sugar has been made from sorghum in this county. The amount of molasses made this year is about sixteen thousand seven hundred (16,700) gallons.

The amount of *Maple Sugar* made annually is about eleven thousand five hundred (11,500) pounds.

Hemp and *Flax* is not cultivated to any extent.

Cotton.—But little cotton is produced. A few of the farmers cultivate small patches for their own use, but none for market.

Tobacco is not extensively cultivated for market. Most of the farmers raise what tobacco they use, which, by the way, is no small quantity. It grows well and does not seem to impoverish the land any more than corn. The amount of tobacco raised last year was twenty-nine thousand two hundred and forty (29,240) pounds.

Cattle.—Cattle are raised largely for domestic use, but not to any extent for market.

Sheep.—This county is admirably adapted to the raising of sheep, but owing to the number of wolves which inhabit the southwestern portion of the county there are but a small number of sheep raised and these are of a common stock, there being no improved breeds in the county.

Hogs.—Hogs do well. The acorns and nuts (here termed mast) are abundant, furnishing food for hogs the year round. The Berkshire is the favorite breed, and is most generally raised. The Chester White, Essex, Suffolk and Irish Grazier do well also. The number of hogs is about twenty-one thousand two hundred (21,200) head.

Horses.—This county is well supplied with horses, among which are the Norman, Morgan and other improved breeds. The number of horses is two thousand six hundred (2,600) head. The average price of horses is from one hundred and fifty (150) to four hundred (400) dollars per head.

Mules and Asses.—A large number of mules and asses are raised and marketed in St. Louis. The number of mules in this county, according to the census for last year, is nine hundred and eighty (980) head. The number of jacks and jennets I have not ascertained.

Grass.—The grass crop of this country is tolerably large. Timothy, Red-top and Clover are generally preferred. Hungarian grass is raised by some of the old German farmers, but not to any extent. The amount of Hay raised last year was estimated at one thousand three hundred and forty-nine (1,349) tons.

Hedges have not as yet been tried in this county.

Fruit.—The people of this county are beginning to realize the benefits of orchards. Those that have orchards are enlarging them to some extent, while those who, until the last four years, thought it a complete humbug to set out fruit trees, are beginning to awake to their own interests, and the demand for young trees is increasing rapidly. Apples succeed remarkably well, while peaches hardly ever fail. Plums, cherries and pears succeed and ripen well. The orchard productions raised in this county last year were fifty-seven thousand and eighty-one (57,081) bushels.

Vineyards.—The culture of the grape is attracting a good deal of attention, and there are already several good vineyards started. Nearly one-fourth of our farmers are setting out vines on a small scale. The principal varieties are the Concord, Isabella, Iona, Hartford Prolific, Rogers' Hybrids and Catawba. The Cynthiana and Norton's have been planted, but owing to the scarcity of the vines, and the high figures at which they are held, there are not many of them planted. The Catawba grows well, and ripens without rot on our high, rolling lands. Respecting the culture of the grape, I think I may venture to say that there is not a county in the State that can compete with ours.

In conclusion, I will merely remark that all this county wants to make it one of the most productive in the State, is for a few enterprising men to settle in it; or, as the backwoodsmen say: "If a few of these Yankees (meaning Eastern farmers) was to move in and take up quarters with 'em."

Hoping that this will suffice for a report for this county, I remain,

Votre vraiment,

JOHN G. McMANUS.

CALLAWAY.

ANNUAL REPORT OF THE CALLAWAY COUNTY AGRICULTURAL AND MECHANICAL SOCIETY FOR THE YEAR ENDING NOVEMBER 1, 1870.

To the Secretary State Board of Agriculture:

The stock of the society is owned by 57 members, owning one share each.

The amount of money on hand, or loaned out is $1,676 99, and about fifteen acres of land adjoining the city of Fulton, with improvements on it that cost over $5,000, consisting of a large and commodious amphitheater, 56 stalls for horses and cattle, and a number of pens for sheep and hogs, all inclosed by a good board fence about seven feet high.

The following is the report of the secretary for the last fair, and presented to the board of directors at their meeting on September 7, 1870:

To the Board of Directors of the Callaway County Agricultural and Mechanical Society:

SIRS: In accordance with the provisions of section four of article two of the by-laws of the society, I herewith make the following report:

Class of Premiums.	Number of premiums offered...........	Value of premiums offered...........	Number of premiums on which there were no entries made........	Value of premiums on which there were no entries made........	Number of premiums awarded............	Value of premiums awarded............	Sweepstake entries.....	Net cost of premiums to the society...........	No. of entries..........
Domestic manufacture...................	37	$116	2	$2	35	$114	....	$114	102
Penmanship................................	2	2	2	2	....	....	....	....	....
Dairy products	14	22	5	7	9	15	....	15	20
Vegetables and fruits.....................	11	12	5	6	6	6	....	6	13
Grain and tobacco........................	12	26	3	3	9	23	....	23	12
Mechanical	5	23	3	8	2	15	....	15	2
Sheep	13	53	5	21	8	32	....	32	17
Hogs.......................................	10	75	2	15	8	60	22	38	34
Thorough-bred cattle....................	14	214	....	....	14	214	60	154	45
Graded cattle.............................	23	207	6	54	17	153	....	153	25
Horses	70	1097	6	79	64	1018	417	601	264
Mules......................................	16	159	4	36	12	123	15	108	33
Jacks and jennets........................	12	119	8	71	4	48	12	36	6
Brass band................................	1	250	....	....	1	250	150	100	3
Total..................................	240	$2,375	51	$304	189	$2,071	676	$1,395	576

RECAPITULATION.

	Number.	Value.
Number of premiums offered and value.....................	240	$2,375 00
Number of premiums on which there was no entry............	51	304 00
Number of premiums awarded and value......................	189	$2,071 00
Sweepstake entries..	....	676 00
Net cost of premiums to society...........................		$1,395 00
Whole number of entries...................................	576	....

RECEIPTS.

For 57 shares of stock.....................................	$1,818 55
Entry fees on sweepstakes..................................	676 00
Rent of stalls...	109 85
Rent of booths, tents, etc.................................	643 50
Gate fees..	2,583 85
Total receipts...	$5,831 75

PAYMENTS.

Orders have been drawn on the treasurer for the following items:

Fair ground	$1,536 43
Repairs	126 68
Printing	56 50
Stamps, stationery and books	17 15
Ribbons, ice and water elevators	23 25
Music	150 00
Salaries	173 75
Premiums awarded	2,071 00
Total payments	$4,154 76
Balance on hand	1,676 99
	$5,831 75

All of which is respectfully submitted.

ISAAC D. SNEDECOR, *Secretary.*

The following is the census report for this county for 1869, and estimates for this year:

		Census report for 1869.	Estimates for 1870.
Number of horses		8,034	8,200
“ mules and asses		3,007	3,150
“ milch cows		6,434	7,000
“ working oxen		531	550
“ other cattle		11,782	12,000
“ sheep		31,115	32,000
“ swine		33,186	35,000
Value of all live stock		$1,655,935	$2,000,000
Bushels of spring wheat		209	200
“ winter wheat		155,504	175,000
“ rye		8,292	9,000
“ Indian corn		962,887	1,500,000
“ oats		389,883	400,000
“ barley		702	1,000
“ buckwheat		33	150
Pounds of tobacco		913,078	1,200,000
“ wool		90,202	100,000
Bushels of Irish potatoes		45,076	45,000
“ sweet potatoes		2,103	3,000
Value of orchard products		$32,899	$300,000
Dairy products	Pounds of butter	210,737	500,000
	“ cheese	5,000	6,000
	Gallons of milk sold	3,493	10,000
Tons of hay		10,731	8,000
Pounds of maple sugar		7,662	8,000
Gallons of molasses		11,039	10,000
Pounds of beeswax		680	1,000
“ honey		22,731	40,000

The value of live stock depends mostly on the market price in St. Louis.

The following is the average price of the articles mentioned:

Spring wheat	$ 80	per bushel.
Winter wheat	1 00	“
Rye	75	“

Indian corn	80	per bushel.
Oats	40	"
Barley	1 00	"
Buckwheat	1 00	"
Irish potatoes	75	"
Sweet potatoes	1 25	"
Apples	75	"
Peaches	1 25	"
Tobacco	15	per pound.
Wool (washed)	50	"
Butter	35	"
Cheese	20	"
Beeswax	30	"
Honey	25	"
Maple sugar	16	"
Milk	20	per gallon.
Sorghum molasses	75	"
Maple molasses	1 50	"
Hay	16 00	per ton.

The time of holding the annual fair is fixed by a constitutional provision for "the next to the last Tuesday in August of each year."

GEO. A. NICOLSON, *President.*

ISAAC D. SNEDECOR, *Secretary.*

FULTON, Mo., November 5th, A. D. 1870.

The Board of Directors which were elected at the annual meeting, elected Chas. A. Bailey, President, Isaac D. Snedecor, Secretary, Wm. H. Bailey, Treasurer—all of Fulton, Mo.

COOPER.

BOONVILLE, Mo., January 24, 1871.

C. W. Murtfeldt, Corresponding Secretary Board of Agriculture:

I am unable to make a report of the condition of the Cooper County Agricultural and Mechanical Association satisfactory to myself, on account of the very short time allowed me; by the request of our president, T. V. Hickox, who a few days since requested me to give you as complete a statement as I could under the circumstances, which I proceed to do.

This society was organized in 1867, under very unfavorable circumstances. The organization was effected without a dollar in the treasury, and the necessary expenses incurred in making improvements and paying premiums left the society, at the end of the first year, indebted in the sum of $1,474 50; but with this indebtedness the board of directors did not hesitate to offer, at the second annual exhibition, a large list of premiums, and to make valuable and costly improvements on the grounds.

The society paid out in premiums this year about $1,700, which, with the expenditures incurred amounted to $2,774 25, with $2,299 75 total receipts.

This large list of premiums awarded and paid to competitors, together with the cost of improving the grounds, in the erection of suitable seats and the improvements necessary to the convenience of persons attending the fair, brought the society in debt $925 50 this year, 1868. With this result the directors of the society, under the circumstances, appeared well satisfied, and did not hesitate to make valuable and handsome improvements upon the grounds of the society and to offer a large annual premium list for the year 1869; and at the exhibition which commences on the 29th day of September and continued five days, the society paid out as premiums about $1,300. The total receipts for the year 1869 were $3,529 46, with total expenditures of $3,011 15, leaving a balance of $518 31 in the treasury on this year's business.

The society held its fourth annual exhibition at Boonville in September, 1870, and paid out in cash premiums $1,505 50, besides making some very useful improvements. The receipts for the year 1870 were enough greater than the expenses to pay the entire indebtedness of the society, lacking about 150 dollars.

There are now thirteen life members, each membership costing $25. These in fact are the only members of the society at this time, as we have what is known as an annual membership, costing the purchaser only $5, and expires on the last day of December of the year in which it is issued. This annual membership entitles the owner of it to to enter any article or animal for any premium offered by the society (sweepstakes excepted) without any additional cost or entry fee, and also allows the owner, if married, to take all his family, under 21 years of age, into the fair each day without any charge. This is a very cheap way for the farmers to attend and compete for all the premiums, except the sweepstakes; but notwithstanding its cheapness the society is still inclined to continue it.

Our society may be considered now as on a sound and self-sustaining basis, if managed, as I have no doubt it will be, with the same prudence and economy that has characterized its past management.

I would be glad if I had sufficient data to enable me to give you an intelligent idea of the unequaled resources of this county. I do not hesitate to say, however, that in variety and fertility of soil it is not surpassed by any county in the State, and is certainly equaled by few. It yields wheat, oats, corn and all cereal grains, as well if not better than many other counties in the State. Besides, there are vast fields of coal and lead, now being developed to the great satisfaction of the owners of these great mines of wealth. The coal of Cooper county thus far has not received very much attention from our citizens, with the exception of our wealthy and enterprising fellow townsman, Capt. J. S. Stephens, President of the Central Missouri National Bank of Boonville, who has spent a large amount of money in opening coal mines in the county within the last two or three years.

In material and mineral resources Cooper county stands not second among the counties of Central Missouri.

The Missouri river running along the entire northern border, with several smalls creeks running through its interior, abundant water power is afforded to carry on any amount of manufacturing in various parts of the county, though Boonville appears to be by nature designated as a site for a large commercial and manufacturing city. We also have a railroad running from Boonville to Tipton on the Pacific railroad, a distance of about 25 miles, giving thereby our citizens the advantage of river and railroad competition for freight, which is of great advantage to the people generally.

We also have another railroad in progress of construction, to wit: the Missouri, Kansas and Texas road, which will cross the river at this point on its way to Chicago. This last road traverses nearly the entire length of Cooper county, from Boonville to the Pettis county line, towards Sedalia. The grading is now nearly completed and extends as far north as Fayette, Howard county, and we confidentially look for its early completion.

Boonville actually has a population of about 4,500, and Cooper county of over 20,000. The assessed value of Cooper county is $5,867,065 00, of which $1,180,900 00 is personal property.

Time and data will not permit me to make this any longer.

JOHN COSGROVE,
Sec'y Cooper Co. Agr. and M. A.

CRAWFORD.

C. W. Murtfeldt, Corresponding Secretary Board of Agriculture:

In compliance with your request, I herewith submit a brief report of Crawford county, to wit:

We have no county agricultural society. Have no county fair. Nothing of the kind ever organized in the county.

POPULATION.

In 1850, free white males	3,189	
Free white females	2,923	
	6,112	
Slaves, males	144	
Slaves, females	141	
	285	
Total		6,397
In 1860, free white males	2,928	
Free white females	2,712	
	5,640	
Free black males	1	
Free black females	0	
	1	
Slaves, males	60	
Slaves, females	70	
	130	
Mulattoes, males	28	
Mulattoes, females	24	
	52	
Total		5,823
1870, total population, all told		7,982
Increase in population since 1860		2,159

The ravages of the late civil war depleted our population to an alarming extent. The exact number cannot now be stated with any degree of accuracy, as the county kept no registry of the loss by natural or military death, removals, etc. Since the spring of 1867, this county has been favored with a small and steady increase by way of New England immigration. Very little foreign immigration.

The general state of society is equal in point of morality, to any county in Southeast Missouri.

Education—The cause of education in this county is not what it should be; there is such a strong standing prejudice against the system of free schools, that it is almost an impossibility to enforce the law as it now stands on the statute. The subject of private taxation for the support of common schools is a great "bug-bear" to many of our citizens—hence out of so much opposition—but little good has been accomplished, and the prospects for the future are anything but pleasant and flattering to the laws of education, sound morality and mental culture. Yet, with all the combined opposition to the public school laws, we have an academy (Steelville Academy), which has now been in successful operation since 1852, now numbering eighty-five students, male and female; and through the influence of this academy, much good has been accomplished.

Up to this date, we have never held a county teachers' institute; but we are now trying to organize one.

GRAIN, ETC.

Wheat, corn, oats and grass are the staple field products of the county.

FRUIT.

The fruit crop of this county is destined to become one of its chief objects, as all kinds of fruit known to this climate grows and matures well, the apple peach and grape in particular.

STOCK.

Horses, mules, cattle and hogs, are the principal stock. Some attention is being given by our best farmers to the improvement of stock, more particularly to mules and hogs.

WATER COURSES.

The Meramec river, with its tributaries, are the water courses of the county, which afford fine soil and timber. Not a single saw mill in the county. Several grist mills, mostly of an inferior quality. This county now needs good saw and grist mills.

MINERALS.

This county is one among the wealthiest in the southeast part of the State, in iron and lead, which exists in rich abundance. We have one iron furnace in the county, situate one and a half miles south of the Meramec river, near the mouth of Cortois creek. This is a hot-blast furnace, twenty ton capacity, makes pig iron only. This county could support at least a half dozen more such furnaces, as the ore is inexhaustible. We have not a single lead furnace in the county; so far, the most of the ore mined and raised in this county, has been sold to the Washington county smelters. Ore is said to yield from 60 to 89 per cent. This county is now offering handsome inducements for the manufacture of lead.

Lands in this county are comparatively cheap, ranging in price from fifty cents to twenty dollars per acres, owing to location, soil, timber, mineral, etc. We have but one railroad through the county, the South Pacific. Within the past six months we have had two trial surveys made for a railroad southward through the county, to connect with the South Pacific, at Cuba station. The prospects for the building of this road are not flattering. Though in our judgment it would be a good paying road, as it would at once call into existence mills and furnaces for the manufacturer of iron, lead and lumber, which here exist in the crude state, and in great abundance.

There are two wool carding machines in this county, which operate on a small scale, and confined to a local trade. The above and foregoing is as correctly stated as it is possible to be given from the data before us. And while we feel a public shame on account of our slowness and old fogy style of improvements, in all and everything that which tend to build up a county, yet we submit the same, hoping the day is not far distant when we shall have turned a new leaf in the industrial and mechanical wants of the county.

Before closing this report, permit me to say what we now most need to build up the county and develop her latent wealth, which are as follows:

We need iron furnaces, lead furnaces, saw mills, grist mills, woolen mills and factories; experienced stock, grain and fruit growers. We want, and greatly need men of experienced minds in different departments of business and trade; want men of brains and backbone; want hardy, honest and intelligent immigration. If you please, we want everything necessary to build up and sustain a community.

Respectfully yours,

J. G. ANDERSON.

GASCONADE.

Chas. W. Murtfeldt, Corresponding Secretary Board of Agriculture:

In compliance with your request, the Board of Directors of the Gasconade County Agricultural Association, respectfully make the following report, and submit it to the State Board of Agriculture, with other statistics of Gasconade county, hoping it may prove beneficial to all concerned, and that feel interested in the prosperity of the State. The Gasconade County Agricultural Association has been and is still being productive of much benefit by encouraging wine-growers, farmers and all other classes of citizens. A history of the association we give herewith as follows, to wit:

The association from its incorporation labored under a great many disadvantages, and it is only due to the perseverance of a few devoted members that the association was made a success, and can now favorably compare with any of our neighboring counties.

Our association is now numbering 140 members, most winegrowers, who take a deep interest in the welfare of the association.

The monthly meetings of the association are interesting, the members communicate the experiments they have made, to each other, and the meetings prove beneficial to all that participate.

The association has also a fair ground, comprising six acres of the finest land in the incorporate limits of Hermann, the county seat.

We have also built a fine structure for exhibition purposes at the cost of $1,800 00. The property of the association is valued at $3,000 00.

The income of the society is about $500 00 annually from different sources.

The officers elect for the ensuing year are Louis Austermell, President; John Fleisch, Vice President; Conrad Klinge, Secretary; William Kielmann, Treasurer. Board of Directors—Philip Schneider, Gottlieb Grossmann and Bernard Petrus.

This year's crop of grain we suppose is about an average yield per acre, in the southern part of the county, with the exception of wheat and barley, which is about three-quarters of the usual crop.

The total product of vineyards in this county is about 200,000 gallons of wine, and about $4,000 worth of plants.

Grapes are cultivated here to a large extent, in fact, it is the main product. The estimate is that about 800 acres are now in cultivation with all varieties of grapes, and considering that there is quite a mania for grape-planting, it is destined to become one of the most important interests of the State.

Fruit-growing is the great business of our county, as the soil is very favorably adapted for the choicest varieties. A few that cultivate negligently, cannot find any profit in it, while others more industrious and thoughtful, believe it just as remunerative, taken as a whole, as any other business they can go at.

Yours, respectfully,

CONRAD KLINGE,

Secretary of the Gasconade County Agricultural Association.

LAWRENCE COUNTY.

MT. VERNON, MO., November 22, 1870.

C. W. Murtfeldt, Corresponding Secretary State Board of Agriculture:

1. That the Society has for the year, 71 members.

2. That the proceeds of the three days' fair, just closed, is........ $287 95
3. That the incidental expenses for the year, amount to 110 80
And amount of premiums awarded during the fair... 266 50
Making total liabilities of the society for the year... 377 30
4. Making deficiency in the proceeds to meet liabilities........ 89 35

Which amount is met and canceled by generous donations by various members who won premiums.

5. That the indebtedness of the society, for expenditures incurred last year, in fencing and improving the fair grounds amounts to about $828 28. A portion of this indebtedness is running at 10 per cent.

6. In response to a proposition for donations to the society, $200 00 was subscribed. If this subscription be paid, it will reduce the indebtedness of the society to $628 28.

7. The society holds a warranty deed to ten acres (more or less) of land, the site of the present county fair grounds, said land is enclosed by a good fencing. The exhibition ring is not very suitably located for the purposes of the fair, and a general vote of the members shows a desire to move the fair grounds to a more desirable locality.

8. There were, during this fair 105 articles on exhibition and 180 animals of various classes and ages. Both the articles and animals are of first-rate quality for the southwest.

9. We have no means at hand of knowing the amounts of the staple products of the county during the year.

Prices current are as follows: Corn, 50 cents per bushel; wheat, $1 00 per bushel; potatoes, Irish, 50 cents per bushel; potatoes, sweet, $1 00 per bushel; hay, $6 00 per ton; pork, 8 cents per pound beef, 7 cents per pound; sorghum molasses, $1 00 per gallon; butter, 25 cents per pound.

10. And finally, there is a steady and marked improvement going on in nearly every department of industry in our county.

11. The following are the Board of Directors of the Lawrence County Agricultural and Mechanical Society, for the year 1871, viz: G. H. Moore, J. W. Moore, E. G. Paris, J. W. Patton, Wm. B. Allen, W. D. Tillotson, James Campbell, Robert Phariss, Wm. K. Gibson, A. G. McCause and J. J. Cheery. T. R. Whaley, Treasurer, and J. H. Woods, Secretary.

12. The present Board are glad to transmit the Society to the Board elect, in a prosperous condition, and take pleasure in stating that this prosperity has been secured to the Society largely by generous donations of various members.

Hoping for the increased usefulness of the society,

We remain,

G. H. MOORE,

J. H. WOODS, *Secretary.* *President Board.*

LACLEDE.

LEBANON, December 6, 1870.

Mr. Charles W. Murtfeldt, Corresponding Secretary :

SIR:—Inasmuch as no report of this county has been furnished to the Board of Agriculture, at your request, I will endeavor to present such facts in regard to its general character and condition as I have been able to obtain.

Laclede county is situated on what is delineated by geographers as the Ozark Mountains, 37°.30 north latitude. Its boundaries are Camden county on the north, Pulaski and Texas on the east, Wright and Webster on the south, and Dallas on the west. The South Pacific Railroad passes in a diagonal direction through the county for forty miles. Another road connecting Lebanon, the county seat, with Fort Scott, Kansas, is in progress of construction.

The face of the country is generally rolling, and in some portions broken and hilly. Nearly every variety of soil is to be found, from the richest alluvial bottoms to rich and flint ridges.

There are numerous small prairies, but the greater part is timber. The bottoms sustaining a heavy growth, while the upland, excepting the prairies, are covered in part with good timber, and in part with scattered, scrubby trees and brush.

About two-thirds of the county is susceptible of cultivation. The most fertile lands are the bottoms along the water courses. The tillable uplands are of venerable character, generally adapted to grass and small grain, while the hills and ridges furnish desirable locations for orchards and vineyards, and supply a vast amount of pasturage.

The principal streams are the Gasconade river. The Osage Fork and the Niangua river touching the western boundary. There are clear and rapid, furnishing unfailing water power, while Abb's Creek, Stean's Creek, Spring Branch and Bear Creek, with numerous springs supply pure water for stock and other purposes.

We have no swamp or marshes. The atmosphere is pure and wholesome.

In respect to timber all kinds of oak found in this latitude are abundant, besides Walnut, Hickory, Elm, Sycamore, Maple, Hackberry, Honey Locust, Hazel, Shumac, Persimmon, Sassafras, Paw-Paw, Buckeye, Haws, Red-Bud, and Willow, also abound. Wild grapes of several varieties are numerous and productive. The wild fruits are the Strawberry, Dewberry, Blackberry, Raspberry, Goosberry, Red and Black Haws, Plums, Crab Apple, Persimmon, and Wild Cherries;

The population of the county is 9,314. The early settlers were most from Kentucky, Tennessee and North Carolina, but since the war there have been a large immigration from the more northern States.

Owing to the great amount of railroad land lying in alternate sections, which has, until recently, been kept beyond the reach of settlers, the organization of schools has been retarded, but with the increasing population more interest is evinced in educational matters, and in fact in all the progressive ideas of the age. A commodious building, for a graded school, will be erected in Lebanon the coming year. Yet throughout the county more thorough and efficient teachers are needed.

There are, in this county, 474,880 acres of land, of which 100,000 acres are held by the railroad company, and about the same amount by the government, subject to purchase or entry under the homestead act.

Rock is abundant, consisting of limestone, flint, sandstone, cotton rock, and other formations. Ores of lead and iron are found scattered over the surface in various parts of the county, and these minerals are believed to exist in large quantities, but no systematic survey has ever been made.

Indications of coal oil are found on the farm of Mr. Von Kochtitzky, on Cobb's Creek, near the Osage Fork, but as yet means have not been obtained for a thorough examination. Persons familiar with the oil regions of Pennsylvania regard the prospect highly flattering.

Coal has not been found in this county, but is being mined thirty miles west, on the line of the Laclede and Fort Scott railroad.

There are in the county six flouring mills, two others that grind corn, eight saw mills, three wagon shops, two brick yards, and several other manufacturing establishments, but none of these are on a large scale; more are needed.

All the improved implements of agriculture have been introduced and can be obtained from dealers here. Yet much is to be observed that brings to mind the old fogy notions of the past. We still find the crude plow of the country blacksmith drawn by a single mule slightly scratching the surface of the soil, while deeper and more thorough cultivation, practiced by better farmers, produces a result so marked in favor of the latter that the wayfaring man may read in passing by. The Laclede County Agricultural and Mechanical Association was organized little more than a year since, and the fair recently held in Lebanon, was creditable to the society and to the county. The whole number of entries was one hundred and eighty-one, of which sixty-two was stock, the remainder being made up of implements, articles of home manufacture, fruits, garden, field and dairy products. Many articles not entered were also placed on exhibition. No permanent grounds have been provided, but the interest evinced has encouraged the directors to move forward, and steps have already been taken to supply the want.

The productions of the county are corn, wheat, oats, rye, sorghum, potatoes, sweet and Irish, tobacco and cotton.

Corn is the staple. The average yield under favorable conditions is from forty to sixty bushels to the acre, occasionally more. The white and yellow are mostly raised.

The crop this year, will exceed 300,000 bushels.

Wheat when well put in, will yield from fifteen to twenty-five bushels. Fall varieties are mostly sown. Underdraining and subsoiling have not been tried to my knowledge, but deep plowing has proved in the highest degree beneficial. Lands that under the old system were supposed to be worn out, have thus been made to yield large crops, revealing the fact that an undiscovered mine of wealth is to be found but a few inches below the surface.

Oats succeed fairly. The average yield is about forty bushels per acre.

Potatoes and all kinds of root crops are productive, and under proper cultivation crops of the finest quality are obtained.

Tobacco is cultivated to some extent and does well, but a factory or better market facilities are needed in the county, as our merchants are restricted by the revenue laws, and but few have taken out license to handle the leaf.

Sorghum is grown for home consumption, and to supply local demand.

Cotton is raised in a small way, for domestic purposes, and succeeds best on high sandy soil.

The fruits principally cultivated are the apple, peach, pear, plums, cherries and grapes.

Apples of the finest quality are produced abundantly, and are usually regarded as a sure crop. We have, however, to record almost an entire failure this season, owing in fact, to the excessive crop of last year, but mainly to a severe freeze in April.

Peaches are raised without difficulty. We have had but one entire failure in four years. The bearing trees are, mostly seedling, yet the fruit is of excellent quality. Orchards recently planted, contain nearly all the improved varieties. Trees all appear healthy, are not affected with the yellows, nor has any trouble been experienced from the curculio. Borers are occasionally found.

There are but few cultivated plums, but an abundance of wild ones.

Cherries are raised to some extent—mostly the Richmond, or early May.

Grapes succeed admirably, and are but little affected by insects or disease, some rot has been noticed on the Isabella. Other varieties as far as tested, have proved healthy and have perfected their fruit. We have no large vineyards, but several smaller ones have recently started. Certainly, no better facilities for the successful cultivation of the grape can be found in the West, than is offered by the bluffs and hillsides of this county.

Stock in this portion of the State was almost entirely swept away by the war, and in consequence a great deficiency still exists. No where are greater advantages presented for stock raising than here. Large bodies of land which must for a long time remain vacant, produce a rich growth of nutritious grasses, while the short mild winters necessitate feeding for a comparatively brief season.

Clover, blue grass and timothy succeed admirably, affording pasturage early in the spring and until late in the fall, when the wild grass has withered and dried up.

The present stock of horses, cattle, sheep and hogs, are principally of the scrub order, but some of our more enterprising farmers, among whom may be mentioned Josephus McVey, Alfred Care and A. F. Lews, have introduced improved breeds of cattle, sheep and swine. Others are not slow to perceive the difference and to understand that it costs no more to rear a valuable animal than one comparatively worthless.

While timber remains abundant it will probably furnish, as at present, fencing material for general use.

Osage Orange has been tried in a few instances, and with proper care proves to be all that can be desired, forming an impenetrable barrier against stock in three or four years. It is not subject to winter-kill, not preyed upon by insects, nor will animals of any kind browse or molest it.

The present season although favorable upon the whole for corn, has been unpropitious as regards most other crops, and fruit. Late frosts and cold storms of unusual severity occurred during the spring. Then followed a severe drouth, which continued until wheat and oats were nearly ripe. During the latter part of the summer and fall, rains have been abundant. Killing frosts did not come until near the middle of November, and up to this time the weather has been mild and pleasant.

In conclusion, I present the following stastistics for which I am indebted to Mr. J. T. Tallaferro, our County Clerk, and to Mr. J. Gochenour, Assistant:

STOCK, YEAR 1869.

Horses in the county	3,127
Mule	427
Neat cattle	7,383
Sheep	8,160
Hogs	13,584
Valued at	$372,400

GRAIN AND PRODUCE, YEAR 1869.

Wheat	53,268
Corn	237,320
Oats	47,470
Tobacco (lbs.)	25,580
Wool (lbs.)	10,930
Butter (lbs.)	68,850
Potatoes (bush.)	23,932
Orchard products (bush.)	10,628
Molasses (gallons)	11,350
Honey (lbs.)	4,394
Value of home manufactures	$ 9,734
Value of slaughtered animals	57,501
Assessed value of property in the county	2,211,216

M. W. SERL.

LEWIS.

SECOND ANNUAL REPORT LAGRANGE AGRICULTURAL AND MECHANICAL SOCIETY.

To Chas. W. Murtfeldt, Corresponding Secretary Missouri State Board of Agriculture:

Number of stockholders	117
Number of acres of land owned by society	30
Number of buildings owned by society	5
Cost of land and improvements (about)	$7,000 00
Receipts of society during current year	$3,312 35
Expenditures " " "	3,247 64
Balance in treasury	$65 01
Amount of premiums paid at second annual fair in September and October, 1869	$1,268 00
No. of articles and animals exhibited	515

Fairs held annually on fourth Monday in September.

Very respectfully,

T. O. FOWLER, *Secretary.*

MARION COUNTY.

C. W. Murtfeldt, Corresponding Secretary:

This county contains about four hundred and fifty square miles, about equally divided between timber and prairie. The general character of the soil for mixed farming is equal to any in North Missouri, and contains a population of 23,780, taxable wealth over $8,000,000.

The corn crop of last year, 1870, was above an average, say fifty bushels to the acre, the range from thirty to eighty bushels. Wheat was also good and above an average, say eighteen bushels per acre. Oats were very short, owing to the drouth in the early part of the season; the Norway oats were a complete failure.

Vegetables were very fine; late potatoes, cabbage and turnips, were at least double any former yield.

The fruit crop was nearly a failure, many large apple orchards not yielding a bushel, and the best not much above a bushel to the tree of choice fruit. We had very few peaches; Hale's Early the principle budded fruit in the market. Seedlings were more plenty, but nothing like a full crop. Some varieties of improved cherries were very good; the May Duke stands at the head of the list for hardiness and bearing qualities. Elton and Yellow Spanish bears very well, but the fruit rots on the tree badly some seasons when nearly ripe. The common May cherries are the hardiest and bear the best.

The farming interests in this county are greatly on the increase. Our farmers are vieing with each other by adopting the most improved methods of cultivating the soil by the use of the very best machinery, and the best system of rotation of crops. The saving of manures and the best time for applying them, are questions that are being agitated by our most enterprising farmers.

There is not only marked advance in relation to farming, but every other interest is also marked with progression. Our public and private colleges and schools are receiving increased attention from our people. Palmyra, our county seat, is noted for her many institutions of learning of a high order. Hannibal is also noted for the high character of its public school system.

The natural growth of our timber is as follows: White Burr, Chincapin, Black, Red, Pin, Water and Black Jack Oak, White and Black Walnut, Cherry, Elm, Hickory, four kinds, Hackberry, Pecan, Hard and Soft Maple, Birch, Dogwood, White, Blue, and Black Ash, Linden or Butter Wood, Sycamore, Cotton Wood, Willow, Buckeye, Sassafras, (Ky.), Coffee Tree, Box Elder, Persimmon, Plum, Crab Apple, Honey Locust, and a great variety of Haws, Spice Wood, Iron Wood, and Wafer Ash.

MANUFACTORIES.

W. J. Quealey is running a foundry and machine shop on an extensive scale. His sales for 1870 were $200,000, and gave employment to one hundred hands, whose wages were from $2 00 to $3 50 per day. He has lately built two large car shops, for the manufacture of cars on an extensive scale. He is using the very best machinery, with all the late improvements, and employing the best mechanics and the best material.

The Hannibal & St. Joseph Railroad Company employed in their machine shops 590 men, average wages $2 65 per day. The value of material used was $812,000; number of new cars built, sleeping palace cars 6, passenger and baggage 12, way cars 15, freight cars 189.

Flour.—Hanly, Metcalf & Co., Palmyra, manufactured 110,000 bushels of wheat, equal to 22,000 barrels of flour. Paid 60 cents for flour barrels; fuel (coal) for twelve months, cost $3,080 00; paid $100 per week for labor and teams; ground 5,000 bushels corn meal.

Lindell Mills, Palmyra.—S. H. Anderson & Co., Proprietors, ground 100,000 bushels wheat—22,000 barrels flour. Make their own barrels, employ six coopers and seven men in the mill; paid mill hands from $1 50 to $3 00 per day.

LIME.

There are two large kilns running in the city of Hannibal, with a capacity of about eighty barrels each daily; also a new one at Bear Creek station, a few miles from Hannibal, that has all the late improvements attached, with a capacity to burn two hundred barrels per day. The company are preparing to make their barrels by steam and raise their stone by the same process; they are also negotiating for a lease for the purpose of building another kiln with a capacity equal to the first. The quarry is a very extensive one, consisting of white lime stone.

There is a quarry in the city from which they are getting the stone for the bridge across the Mississippi at Hannibal, which has been tested and pronounced equal to any in the West for strength. There are about 2,000 men and 200 teams at work on the bridge and approaches to it on each side of the river. The cars will probably be running over it before the public eye sees this description.

LUMBER TRADE.

G. C. Hixon & Co., manufactured in 1870, in nine months, 15,000,000 feet, and about 5,000,000 of shingles and lath. Hinton & Co.'s mill about 12,000,000 feet.

Statistics of the Lumber Trade of Hannibal, Mo., for the year 1870.

LUMBER.	
Amount of feet on hand January 1, 1870	29,350,000
Received during year 1870	81,075,000
Sold during year 1870	70,600,000
Amount on hand January 1, 1871	39,825,000
LATH.	
Number on hand January 1, 1870	5,004,000
Number received during the year 1870	23,575,000
Number sold during the year 1870	23,259,000
Number on hand January 1, 1871	5,320,000
SHINGLES.	
Number on hand January 1, 1870	4,060,000
Number received during the year 1870	25,105,000
Number sold during the year 1870	26,732,000
Number on hand January 1, 1871	2,433,000

PORK PACKING.

A. J. Stillwell slaughtered and packed 3,320 head of hogs, averaging 280 pounds, live weight; price, $5 94½ per hundred gross.

Brice, Stillwell & Sons packed 3,209 head, averaging 270 pounds gross; average price, $5 88.

G. W. Thompson & Co., Palmyra, packed, in 1870–71, 2,760 head of hogs; average weight, gross, 280 pounds; average price paid per pound, gross, $5 60.

INSURANCE COMPANIES.

National Insurance Company of Hannibal, Mo. Capital stock, $300,000. Amount of premiums received up to January 1, 1871, is $174,642 27. Total losses paid is $40,619 65.

State Insurance Company. Authorized capital, $1,000,000. Income for 1870 is $92,731 93; amount at risk is $5,333,137 00.

RAILROADS.

The Hannibal and St. Joseph Railroad is 208 miles long. Your report has been furnished with a descriptive report heretofore.

Hannibal and Missouri Central Railroad. The following report is taken from a Manual of the Railroads of the United States for 1870–71, by Henry V. Poor:

Line of road from Hannibal, Mo., to Moberly (North Missouri Railroad) distance, 70 miles. Gage of track, 4 feet 8½ inches; rail, 56 pounds to the yard. The road is more than half finished (it is now nearly graded), and track-laying will commence in May, and is to be completed in the early fall. Capital stock paid in January 1, 1870, $450,000. A. W. Lamb, President.

In connection with this road is the North Missouri and all its branches, thus giving to Hannibal direct connection with Kansas City and Fort Scott in the Southwest, and Ottumwa and Oskaloosa Iowa.

Hannibal and Naples Railroad. Line of road; Hannibal, Mo., to Naples, Ill., 45 miles; branch, Maysville, Ill., to Pittsfield, Ill., 6 miles; siding and other tracks, 4 miles; gauge, 4 feet 8½ inches; rail, 56 pounds to the yard. Rolling stock supplied by the Toledo, Wabash and Western, in connection with whose road this road is operated. Opened January 1, 1870. G. W. Shields, President.

St. Louis and Keokuk Railroad. Line of road: Wentzville (North Missouri Railroad) via Hannibal to Keokuk, Iowa, 130 miles. This road will start from Wentzville, 42¾ miles northwest from St. Louis; thence to Hannibal, 75 miles; from Hannibal to Keokuk, 55 miles. From Hannibal to Wentzville the company have a subscription of ten per cent. county bonds, amounting to $700,000, sufficient to grade, bridge and tie the road. For running and equipping the road, the company is preparing to issue a first mortgage bonds. A portion of this road north of the Hannibal road has been graded by the Mississippi and Missouri Air-Line company, with which consolidation is intended. Josiah Fogg, President. This road has been graded through Ralls county, and the bridge across Salt river is fast approaching completion. Grading is also progressing in Lincoln county.

BANKS.

We have six banks doing business in this county, with the following amount of capital:

First National Bank, Hannibal—

Capital	$200,000 00
Circulation	180,000 00
Deposits	326,735 00
Surplus	43,557 00

Farmers' and Merchants' Bank of Hannibal—

Capital	200,000 00

Began business January 10, 1871.

J. G. Eastin & Co.'s Bank, Hannibal—

Capital, circulation and deposits	150,000 00

Hannibal Savings Bank—

Capital	500,000 00
Deposits	2,000,000 00
Surplus	1,100,000 00

Marion County Savings Bank—

Capital stock	100,000 00

Paid in	$50,000 00
Assets from all sources	220,647 08
Liabilities	220,647 08

[Statement sworn to by J. W. Russell, Cashier.]

First National Bank, Palmyra—

Capital stock paid in	100,000 00

Began business January 1, 1871.

J. M. Bates, President.

SECRETARY.

NORTH MISSOURI STOCK, AGRICULTURAL AND MECHANICAL ASSOCIATION.

SALISBURY, Mo., Februry 15, 1871.

C. W. Murtfeldt, Corresponding Secretary:

DEAR SIR: In reply to yours of the 13th inst., I will state that the North Missouri Stock, Agricultural and Mechanical Association held its last fair at the the fair ground near this town during last September.

The display of stock was good—in fact, it was fine.

Our association has not for the last two years offered premiums for products of the farm, or for articles of domestic manufacture.

At a meeting of the stockholders, held in October of last year, it was agreed that hereafter premiums should be offered for farm products and for articles of domestic manufacture, especially on articles manufactured by ladies. Ample rooms will be provided for a good exhibition of all articles sent here to be exhibited.

Our association is not composed of "old fogies;" we believe "blood will tell," and as it desirable to raise horses that can "head a cow in a lane" we give very liberal premiums for running as well as for trotting horses.

Our last premium list for speedings amounted to nearly three thousand dollars, and liberal premiums were given for all kinds of stock and agricultural implements.

Hereafter our fair will commence on the last Tuesday in September in each year.

The receipts of our last fair were about $550 over and above expenditures.

The officers of the association for 1871 are:

Joseph H. Finks, Lucius Salisbury, Milton L. Hurt, Wm. J. Harvey, Robert Duff, Wm. J. Parks, F. J. Dysart, Directors.

Lucius Salisbury, President; Joseph H. Finks, Vice President Thomas E. Brommall, Secretary; T. F. Dysart, Assistant Secretary William Clarke, Treasurer; James A. Johnston, Marshal.

Our fair grounds are furnished with a good half-mile track, scarcely half of a mile from the business part of town, and convenient to the North Missouri railroad and to the Missouri and Mississippi River railroad, which will be in operation before our next fair.

Your obedient servant,
LUCIUS SALISBURY,
President N. M. S. A. and M. Association.

MILLER.

To the Secretary of the State Board of Agriculture:

DEAR SIR: Permit me to address you in behalf of our Agricultural and Horticultural Association, which was organized June 18th, 1870. Our constitution (with a few changes necessary) is the same as that of the State Horticultural Society.

Officers for this year.—S. T. Harrison, President; S. McWilliams, Secretary; T. E. Bailey, Treasurer.

Present number of members, 33.

Meetings are held (as a Farmers' Club) on the first Saturday of every month, at which we have addresses, discussions and exhibitions, and as soon as we have strength and means we intend to purchase grounds and erect the necessary buildings for the purpose of holding annual fairs.

We would desire to be recognized by the State Board of Agriculture, and receive the encouragement which it gives in reports and other documents, and we would be glad to receive instructions in regard to making reports to the State Board. Let us know what is wanted and we will try to do our duty.*

The name of our society is "North Miller County Agricultural and Horticultural Association."

Our county is divided by an, as yet, bridgeless river; therefore, we have, for the present, taken only the north part of the county for our field of operations.

Yours, etc.,
S. McWILLIAMS.

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* There is no doubt but the Secretary of the North Miller County Agricultural and Horticultural Association will find models for reports from those of other counties in this volume.—[ED.

PIKE.

PIKE COUNTY AGRICULTURAL AND MECHANICAL SOCIETY, AT LOUISIANA.

LOUISIANA, Mo., February 20, 1871.

Chas. W. Murtfeldt, Esq., Corresponding Secretary, Missouri State Board of Agriculture, St. Louis, Mo.:

DEAR SIR: Below I submit to you a report for this society:

It is called the "Pike County Agricultural and Mechanical Society, at Louisiana," in contradistinction of the "Pike County Agricultural and Mechanical Society, at Ashley," which is located at Ashley, in this county, eighteen miles southwest of this city.

This society was organized November 21, 1868, and has held two annual fairs. The stock of the society is divided into shares of twenty-five dollars each, of which 528 shares have been paid up, giving it a paid up capital of $13,200. In addition thereto, 143 shares have been subscribed, which remain wholly unpaid, or paid only in part.

The grounds of the society cost five thousand dollars, and embrace about twenty-five acres. This tract of land has not yet been entirely paid for. The improvements made upon the grounds have cost about $21,341 50, a portion of which yet remains unpaid. The The debts owing by the society, aggregating about $8,000, are bearing interest at the rate of ten per cent. per annum.

The grounds of the society are situated immediately on the Louisiana and Middletown gravel road, one and a half miles from the river, and near to the line of the Louisiana and Missouri River Railroad. They have been well fenced, and the improvements consist of a half mile track, a sixth mile ring, with amphitheatre three-fourths around it, with a beautiful pagoda in its centre, ladies' refreshment room, directors' room, commodious gothic halls for the exhibition of textile fabrics, and for farm, orchard and garden products, a large shed for agricultural implements and machinery, one hundred and seventy-one stalls for stock, and portable pens for sheep and hogs. An abundance of excellent water is obtained from two wells, and a never-failing supply of stock water is afforded by a spring branch which runs through one corner of the grounds. The grounds slope gently to the south, and have been pronounced second to none in the State, those of St. Louis excepted.

The last fair of the society (the second) was held for six days, commencing on Monday, September 26th.

The premium list was divided into six classes, as follows:

Class A.—Cattle; M. R. K. Biggs, superintendent.

Class B.—Horses, jacks and mules; Abe Haff, superintendent.

Class C.—Hogs, sheep and poultry; John E. Shannon, superintendent.

Class D.—Farm, orchard and garden products; Major A. McMoore, superintendent.

Class E.—Agricultural implements and machinery; Mijamin Templeton, superintendent.

Class F.—Textile fabrics; A. B. Ayres, superintendent.

Classes A and B were divided into a programme that extended throughout the entire week.

The other four classes were passed upon by the various committees on the third, fourth and fifth days of the fair.

Premiums were offered as follows:

Class A,	53	premiums, amounting to........	$783 00
" B,	163	" "	2,200 00
" C,	39	" "	288 00
" D,	148	" "	364 00
" E,	94	" "	214 00
" F,	99	" "	131 00
Aggregating,	596		$3,980 00

In addition to the above diplomas (of which the society has a beautifully engraved one) were offered as follows:

Class D, 16 diplomas.
Class E, 93 diplomas.
Class F, 72 diplomas.
Aggregating 181 diplomas.

At the last fair no entrance fees were charged upon stock or any other article entered for exhibition. All premiums, except a few copies of *Colman's Rural World*, were paid in cash.

The receipts from all sources were about as follows:

Stall rents..	$200 00
Booth rents..	378 00
Licenses..	110 50
Gate fees..	3,6 3 00
Total..	$4,341 50

*The expenses were about as follows:

Premiums paid..	$4,306 95
Expenses of all kinds..	450 00
Total..	$4,756 95

Showing a deficit of about $415 00.

The officers of the society for the last year were R. C. Pew, Presikent; P. P. Parker, Vice President; R. E. Pleasants, Secretary, and J. E. Carstarphen, Treasurer.

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*The reason why the amount paid for premiums is greater than the amount offered is, that in classes C, D, E, and F, the judges gave premiums to quite a number of articles judged to be meritorious, upon which the society had not offered premiums.

The board of directors consisted of R. C. Pew, D. E. G. Taylor, J. H. Shaw, Wm. H. Mitchell, F. A. Suda, Wm. Stark, E. B. Stark Wm. Pritchett and P. P. Parker.

The officers for the present year are Wm. Stark, President; Wm. H. Mitchell, Vice President; R. E. Pleasants, Secretary, and J. E. Carstarphen, Treasurer.

The following gentlemen constitute the board of directors, to wit: R. C. Pew, Wm. Stark, E. B. Stark, Wm. Pritchett, William H. Mitchell, Wm. K. Biggs, P. F. Lonergan, J. H. Kissinger and J. E. Jordan.

Although neither fair of the society has been a financial success, both fairs have given universal satisfaction to both exhibitors and spectators. Our fairs have also attained a reputation for liberality and fairness second to no others of the State outside of St. Louis.

By the time of our third fair we will have extensive railroad connection with the interior of both the great States of Missouri and Illinois. We will have connection with Mexico and the North Missouri railroad, and by the branch of the Louisiana and Missouri River road with Jefferson City and the Missouri Pacific railroad. Eastward we will have connection with Whitehall and the St. Louis, Alton and Chicago railroad.

We also expect by that time to have the St. Louis and Keokuk road from St. Charles, through this city, to Hannibal, and by a branch road, from this city to Quincy, Illinois.

The completion of these roads, making our city a great railroad center, and our river, will afford owners of stock and spectators easy access to our fair, and we confidently hope that it will result in greatly enlarged receipts into our treasury at our next and all subsequent fairs.

By a resolution, adopted by the board of directors of this society at the time of its organization, the time for holding its fairs was permanently fixed for the week before the St. Louis fair. That resolution has never been repealed.

Very respectfully yours,
R. E. PLEASANTS, *Secretary.*

PIKE COUNTY.

BY R. E. PLEASANTS.

Charles W. Murtfeldt, Corresponding Secretary, State Board of Agriculture:

Pike county is one of the oldest, largest and richest counties in the State of Missouri. It was organized in the year 1819, has an area of about 650 square miles, and a population of 23,085.

The taxable wealth of the county, according to the last assessment, $7,516,880, an increase of $185,780 over that of the previous year. The taxable wealth of the county consists as follows, to-wit:

Real estate, $4,940,850; horses, $452,165; mules, $138,470; neat cattle, $278,560; sheep, $17,825; hogs, $81,890, and all other taxable property, $1,607,120.

The surface of the county is varied. Along the margin of the Mississippi river the surface is somewhat broken, with a very rich limestone soil, nearly all susceptible of culture, and affords the best fruit and grape lands in this, *the great fruit county of the West.* A few miles back from the river the surface approaches nearer to a level, and while the soil continues to produce fruit, grapes, etc., that portion of the county is perhaps the best for tobacco and wheat. The central and western portions of the county are high and nearly level, and are principally prairie lands, and furnish some of the best corn, oat, grass and stock farms of the county. Apples and peaches are also produced. In all portions of the county corn, oats, grass and vegetables succeed well, and whenever the undergrowth in the wooded lands becomes killed out, or the wild prairie grass becomes eaten off, the prairies, a spontaneous growth of blue grass, equal to the celebrated Kentucky blue grass, immediately succeeds, affording the most excellent natural pasturage. The hilly portions of the county are well supplied with springs—principally limestone or hard water—which supply an abundance of excellent water for all purposes. Elk Springs near Spencersburg, and Buffalo Lick, near Louisiana, are two mineral springs that have acquired some reputation for the medical properties of their waters.

From a well, situated in Salt River Bottom, nine miles northwest of Louisiana, that was a few years ago commenced to be bored for coal oil, a large stream of water, highly charged with salt, is constantly flowing. While the central and western portions of the county are not so well supplied with natural springs, they possess a clay subsoil, which is impervious to water, rendering it quite easy to construct cisterns and stock ponds.

Good building stone is easily attainable in all the hilly portions of the county. Eight miles southwest from Louisiana, and the line of the Louisiana and Missouri River railroad, is a most excellent quarry of Magnesian limestone. It lays in strata from four to eight feet thick, is easily quarried and worked, resists the action of frost, and has been pronounced by competent judges to be fully equal to the celebrated Joliet and Grafton stones of Illinois. The county abounds in excellent limestone—stone equal in all respect to those at Alton, and with the early completion of the Louisiana and Missouri River railroad, the quantity of lime supplied from this county to the central portions of North Missouri must be very considerable.

Most excellent brick clay is found in all portions of the county.

Fire clay also exists in a few localities, but is not being worked. Potters' clay is also thought to exist, but has not yet been tested.

All the creek beds abound in a most excellent gravel that has been uncovered wherever the bed of the creek has reached the drift which underlies the loam of the lower lands. This gravel is one of the best material known for the construction of gravel roads, macadamizing streets, and ballasting railroads. The intelligent and enterprizing citizens of "Old Pike" have constructed several excellent gravel roads of it. Two such roads give Clarksville communication with the interior portions of the county, and three others radiate from Louisiana.

All the hilly portions of the county, and the greater part of the river bottoms were originally covered with dense forests, and now, where the forests have not been cleared out, there is an abundance of excellent timber, both for building and mechanical purposes and for fuel. The principal kinds of timber are all the various kinds of Hickory and Elm, Honey Locust, Ash, Birch, Black Walnut, Butternut, Pecan, Coffee Bean, Willow, Hackberry, Mulberry, Linn, Maple, Sugar Maple, Wild Cherry, Black, White, Burr, Post, Pin and Spanish Oaks, Cottonwood, Box-elder, Dogwood, Redbud, Sassafras, Plum, Persimmon, Buckeye, Paw-paw, Hornbeam, etc.

The climate of the county is equal to that of any county of North Missouri. Springs, summers and autumns are generally very pleasant. The winters are generally cold, but rarely extend over three months.

Pike county is as healthy as any county in the West.

The wild game of the county, with the exception of geese, ducks, prairie chickens, partridges, quails, squirrels, etc., have been almost exterminated, but the Mississippi and Salt rivers, and the mouths of the larger creeks emptying into them, abound in cat, buffalo, pike, bass, sturgeon, and other kinds of excellent fish.

Louisiana, a city of 4,000 population, situated on the Mississippi river midway from St. Louis to Keokuk, is the largest town of the county. It is pleasantly situated, is one of the healthiest locations on the river, and is at present rapidly improving. It is the eastern terminus of the Louisiana and Missouri River railroad, the main line of which will cross the North Missouri railroad at Mexico, the Missouri river at Glasgow, and extend westward to Kansas City, then connecting with all the roads that concentrate at that western railroad centre. A branch road will leave the main line at Mexico, and will extend to Jefferson City; there making important connections. Louisiana is also the western terminus of a road from Roundhouse, on the St. Louis, Alton and Chicago road. The latter road, and the main line of the Louisiana and Missouri River railroad from Louisiana to Mexico, and the branch from Mexico to Jefferson City will be com- ted and in operation before the first of next September. The St. s and Keokuk road will also run through the county from north to south. This road has not yet been positively located. There are two competing routes through the county, the central route going by Bowling Green, the county seat, and the eastern route by way of Louisiana. If the road should be built upon the latter route, it is expected that a road will be built from Quincy, Illinois. to a point opposite Louisiana, and also one from some point near New London, in Ralls county, to Monroe Station, on the Hannibal and St. Joe railroad, thus shortening the distance by rail from St. Louis to St. Joseph about forty miles.

In addition to all these contemplated railroad facilities, the county has cheap and speedy river connection both north and south. The upper Mississippi is the safest navigable river in the west, if not in the whole United States. St. Louis is only one hundred and ten miles from Louisiana, and one hundred from Clarksville. Daily lines of first class packets pass both ports in the evening, and arrive at St. Louis about daylight next morning. Returning, they leave St. Louis at 4 o'clock P. M., and arrive at Clarksville and Louisiana early next morning, thus affording a speedy, cheap and pleasant means of travel, with the loss of but little time. Freight can also be shipped at the same time, allowing business men to accompany their freights and personally superintend and dispose of the same if they are so disposed. This is an advantage that railroads do not present, unless shippers will pay exorbitant express charges, or are content to travel on slow freight trains.

Clarksville, eligibly situated on the Mississippi river, ten miles below Louisiana, is the second town of importance in the county. It is a thriving place of near 2,000 inhabitants.

Bowling Green is situated near the center of the county, on the line of the Louisiana & Missouri River Railroad. It is a thriving little place of near 1,000 inhabitants, is eleven miles from the river, to which it has a good graveled road, which is being extended eight miles further to Ashley, the fourth town in population and importance in the county.

The other towns of the county are Prairieville, Paynesville, Frankford, New Harmony, Curryville and Spencersburg. Curryville is situated eight miles west of Bowling Green, and on the railroad. Frankford will be on or near the St. Louis & Keokuk road, and now has a good gravel road to Louisiana.

The society of the county is composed chiefly of, and receives its tone from the descendants of the original settlers of the country, who came from Virginia and Kentucky. Morality, intelligence and hospitality are distinguishing traits of the citizens of the county. In politics the county is strongly democratic. It is well supplied with churches and church buildings, there being scarcely a neighborhood that has not its church organization of some kind. The organized denominations of the county embrace New and Old School and Cumberland Presbyterians, Methodist Episcopal, both South and North, Baptist, Christian, Episcopal and Roman Catholic.

The county is also well supplied with schools. In addition to its common school system, excellent high schools are located at Louisiana, Clarksville, Bowling Green, Ashley, Curryville and other points in the county, thus giving its citizens facilities for giving their children finished educations at home institutions.

There are three newspapers (all weekly) published in the county, namely: The *Louisiana Journal* (Dem.) and *Louisiana Gazette* (Rep.), published in Louisiana, and the *Clarksville Sentinel* (Dem.), published in Clarksville.

The staples of the county are wheat, tobacco, corn, grass, oats, horses, mules, neat cattle and hogs. "Old Pike" has been the recipient of a large per cent. of the premiums offered at the various tobacco warehouses of St. Louis, and Pike county wheat has long been held in high esteem.

Apples and grapes are fast becoming a great source of profit to fruit growers, and Pike county is rapidly becoming as famous for its fine fruits, as it was notorious in the early mining days of California for being the home of Joe Bowers. Large apple and peach orchards abound in the county, and there are several extensive vineyards in the vicinity of Louisiana and Clarksville. Already the wine and grape business of the county have become both extensive and profitable.

At one time a considerable quantity of hemp was grown in the county, but of late its culture has been abandoned.

A few gentlemen have commenced the culture of hops. One gentleman has gone into the business on an extensive scale. He has matured two or three crops, which proved to be very satisfactory, both in quantity and quality, if not in price.

Several parties have recently gone into the dairy business. They make excellent cheese, which finds a ready market at home. With the natural blue grass pastures and excellent spring water of the county, it ought soon to become a large butter and cheese producing district.

Broom corn has been cultivated to a limited extent, and has yielded good results.

During the high prices of sugar and molasses, consequent upon the war, the culture of sorghum was introduced, but since the close of the war and the collapse of the prices of those necessities, its culture is being gradually abandoned.

The wealthy, intelligent and enterprising stock growers and farmers of the county have long been wide awake upon the subject of agricultural societies. Before the war a society was organized at Bowling Green, which held several fairs, but during the war it became involved and disorganized. At its close the Pike County Agricultural and Mechanical Society, located at Ashley, was organized, and since its organization it has regularly held annual fairs; doubtless the improved condition of the stock of the county owes much to that laudable emulation which all such well conducted societies always engender.

Two years ago the Pike County Agricultural and Mechanical Society, at Louisiana, was organized, and has held two fairs, each of which was a complete success, except financially.

The Pike County Farmers' Club, located at Louisiana, although less than a year old, promises to do much toward accomplishing the ends for which it was organized.

In such a report as this, it may be out of place to indulge in personalities, but the stock growers of the county owe so much to the liberality and enterprise of Mr. J. H. Kissinger, near Clarksville, and Mr. Wm. Pritchett, near Frankford, that they at least will pardon this acknowledgement so well merited by each of those gentlemen. They have each, at great trouble and expense, imported large herds of thoroughbred short horns, and, as a reward, each has been the proud recipient of many hard contested blue ribbons, both at home and at the St. Louis and other fairs. The latter gentleman has broken up and disposed of his large herd of excellent cattle, but the stock of the northern part of the county has been greatly improved by it, while it was in its neighborhood. Many other gentlemen are manifesting a very laudible spirit of improvement of their stock, and are introducing the best bloods of horses, jacks, cattle, hogs and sheep, and soon, if not now, Pike county will contest the palm with the blooded stock of Kentucky and Ohio.

PHELPS.

Rolla, Mo., December 6, 1870.

C. W. Murtfeldt, Corresponding Secretary, State Board of Agriculture:

Dear Sir: In accordance with the requirements of the statute, I herewith present a statement of Phelps County Agricultural, Mechanical and Horticultural Society."

This society was organized in January, 1869, but failed to make much progress that year. During the early part of 1870, however, the officers went to work with the determination to succeed, and the result is—a successful fair held this year, ground purchased for the holding of future exhibitions, lumber bought for fencing, and a respectable unpaid stock subscription.

In the month of July it was decided to fit up a temporary place for our first exhibition, and that we have a fair on September 27th and 28th. The weather proved propitious, and the exhibition as a whole exceeded our most sanguine expectations.

Total number of entries	498
No. of horses of all ages entered	47
No. of mules and jacks of all ages entered	10
No. of cattle of all ages entered	28
No. of hogs of all ages entered	26
No. of premiums awarded	181
Value of premiums awarded	$332

We were favored with an interesting address by Wm. Muir, Esq., of St. Louis, on the second day of the fair.

The exhibition aroused much interest among all classes of our citizens, and will have a marked effect toward the improvement of stock and agricultural interests generally throughout our county.

Number of members, 1870, 212.

FINANCIAL CONDITION.

Receipts.

Yearly membership	$212 00	
Gate fees at fair	134 75	
Sales of articles donated	205 25	
Paid on stock subscriptions	275 00	
On hand from 1869	18 00	
Donated by county court	150 00	
		$995 00

Expenditures.

Lumber	$300 00	
Fitting temporary fair ground	86 00	
Printing	51 00	
Police	30 00	
Incidentals	35 00	
Paid for fair grounds	300 00	
		$802 00
Total in hands of Treasurer		$193 00

Assets of Society.

Cash on hand	$193 00	
Fair ground, 30 acres at $30 per acre	900 00	
Unpaid stock subscriptions	1,200 00	
		$2,293 00

Liabilities.

Premiums unpaid	$200 00	
Sundry accounts	200 00	
		$400 00
Leaving a balance of		$1,893 00

with which to commence the new year.

The officers of our society for the present year, are as follows:

President, E. W. Bishop; Vice President, W. J. Brokaw; Secretary, H. E. Baker; Corresponding Secretary, H. L. Wheat; Treasurer, S. Ruggles.

Directors—E. W. Bishop, W. J. Brokaw, H. Ruggles, T. Q. Emerson, J. S. Frost, W. J. Hawkins, J. H. Mitchell, H. Cleino and A. Newman.

Phelps county is making rapid progress in the right direction. Our population has increased from 5,600 in 1860 to 10,500 in 1870, and our taxable property from $1,045, 000 in 1866, to $2,871,100 in 1870.

The following from assessment made September, 1869, shows amount of live stock in the county at that time:

2,492 horses valued at	$115,994 00
428 mules and asses, valued at	23,920 00
7,612 cattle, valued at	121,867 00
9,925 sheep, valued at	15,531 00
13,655 hogs, valued at	25,715 00

A hasty examination of the late census report, gives the following as some of the products of Phelps county for the year 1869:

Wheat, bushels	50,000
Corn, bushels	150,000
Oats, bushels	25,000
Rye, bushels	3,000
Potatoes, bushels	25,500
Tobacco, pounds	8,000
Butter, pounds	77,000
Sorghum, gallons	7,500
Wine, gallons	500

MANUFACTURES.

Flour and meal, value		$270,000
Woolen fabrics, value		20,000
Wagons and carriages		37,000
Saddlery, value		18,000
Tin ware, value		7,000
Lumber, value		13,000
Tobacco, value		6,000
Boots and shoes, value		5,000
Leather, value		10,000
IRON—Pig, tons	3,600	342,000
Blooms, tons	1,500	
Castings, tons	500	
Ore, tons	12,000	

Phelps county has probably as bright a prospect for the future as any county in this Empire State of the West. Well adapted to grain and stock raising, as well as to fruit and dairying, and situated among the hills of the Ozark range, along the thirty-eighth parallel of latitude, with the great Atlantic and Pacific Railroad running diagonally through the county from northeast to southwest, our position is better than most other counties. We have abundant water power, also, as yet but little used. What we most need is capital and labor, and they will not be long finding us.

For healthfulness, we challenge all other sections of our broad country. The late census returns show for the past year but forty-two natural deaths in a population of 10,500.

From a record kept by a citizen of Rolla, during the past four years, the mean temperature is shown to be about 44° during the month of November, and as I write this, December 5th, the weather is similar to the first of May in New York State.

The forthcoming report of our State Geologist will show that the mineral wealth of Phelps county—as yet very little developed—is exceedingly varied and abundant, and consists of iron, lead, copper, nickel, cobalt and variegated marbles—also zinc, etc.

I had almost omitted to mention the "District Fair Association," located in St. James, Phelps county, and owning ample grounds and buildings. Their first annual fair was held this year, and was a success. I trust the secretary of that association will prepare an exhibit for your use.

Hoping that the report for the coming year may prove more satisfactory in every respect than this one, I have the honor to remain,

Your obedient servant,

H. L. WHEAT,

Corresponding Secretary Phelps Connty Agricultural, Mechanical and Horticultural Society.

PHELPS COUNTY AGRICULTURAL SOCIETY.

An adjourned meeting of the "Phelps County Agricultural, Mechanical and Horticultural Society," was held at the court house in Rolla, on Saturday, February 4th, E. W. Bishop, President in the chair.

Bills amounting to $119 80 were presented, examined and allowed in warrants and society stock.

On motion, the corresponding secretary was directed to issue 500 stock certificates.

On motion, an election of officers for the ensuing year was ordered, and H. Baker and W. B. Tallman were appointed tellers.

A ballot for directors resulted in the election of A. F. Pack, H. Ruggles, Henry Cleino, Albert Neuman, E. Seest, T. Q. Emerson, E. W. Bishop, H. L. Wheat.

W. B. Tallman was elected recording and corresponding secretary.

Stillman Ruggles was unanimously elected treasurer.

E. W. Bishop was elected president, and A. Neuman, vice president.

A vote of thanks was tendered to the old officers, and the society adjourned to meet on the first Saturday in March, at 2 P. M.

JASPER.

Charles W. Murtfeldt, Corresponding Secretary Board of Agriculture:

Dear Sir—The Second Annual Fair of our Southwest Missouri Stock and Agricultural Association was held on the 20th, 21st and 22d of September, 1870, and while our first fair surprised in its success, our second was a still more gratifying success without surprising us, for we expected progress, advancement and prosperity in our fair in proportion to the prosperous development of the material interests of our county.

The grounds upon which our first fair was held were sold by the Association, and the net proceeds, $2,000, were applied upon the purchase of thirty acres. Price, $3,840, more favorably situated, being within one mile of Carthage, and beautifully situated upon the north branch of Spring river; there could hardly be a more natural location for a model fair; the clear and pure waters of the river rapidly rolling down its gravelly bed forms the southern boundary, and from which the level bottom stretches towards the north far enough to give ample room for a circular half mile track before reaching a beautiful grassy hill, at the base of which there are a number of fine, shady trees, and whose sides are just abrupt enough to invite resolute pedestrians to attempt its ascent, and which the more irresolute can accomplish by resting under an occasional shade tree, but when the beautiful grove of young timber is reached, which encircles the top of the hill, every one will feel well repaid for their up-hill journey of some three hundred yards, in having a complete view of everything in and about the fair grounds. A natural ampitheatre, capable of being improved and beautified to almost any extent.

Our Association's committee on fair grounds, were much hindered in their preparations by rain and mud; the fence around the grounds was not completed, and the buildings, stands, stables, etc., were but temporary structures.

For many days preceding our fair the roads and prairies were muddy, and as indications of showery weather still continued, the morning of our first day, September 20th, was not as brisk, and not as many entries as there otherwise would have been. A little after noon it began to rain in good earnest and kept it up until there were no more hopes of doing business that day; the track was completely flooded, and we left the grounds with our ardor, as well as our clothing, considerable dampened. It seemed then that we should be obliged to postpone our fair, but much of the water soaked away during the night, and the morning of the second day dawned brightly. What a Southwest Missouri sun cannot do in a short time for the soil of Jasper county, no other county need undertake to boast of. Why, sir, we plow here the next day after hard rains, and the soil never bakes; but we're only reporting our fair now.

The track dried off so well that before night the trials of speed was completed between the single roadsters, matched roadsters and pacing horses, and was well performed without injury to the surface of the track.

The fine art gallery was filled to overflowing.

The domestic arts were well represented.

The agricultural implements and other articles manufactured in Southwest Missouri, were very complete and satisfactory.

The display of horses was excellent, evidencing much interest amongst us for the best improved stock.

There were some fine cattle, but not as many entries as was expected or as there would have been but for the condition of the weather.

There were but few jacks, jennets and mules.

There were several entries of very fine sheep.

The swine were but poorly represented in numbers. A few of the best improved breeds were shown.

There were many entries of fruits, jellies and preserves in splendid condition.

There were but few entries of poultry, while the farm and garden, kitchen and dairy were quite neglected, there being but seventeen entries in these last two departments, but we are well assured that these most important departments in a first class stock and agricultural county, would have been well filled if the weather had been more favorable; perhaps our farmers were a little lax in this matter, and although our county is still quite new, yet we hope that next fall will find these departments just as they always should be, among the most attractive features of our fair.

There were many articles belonging to the various departments, that, owing to the rain, arrived too late to be entered.

There were also quite a number that deserved and received honorable mention, that could not be classed in any department in the catalogue.

The ladies' equestrianism was an interesting feature, resulting satisfactorily.

The premium of $25, for the best band of music, was deservedly bestowed upon the "Carthage Silver Cornet Band," who without competitors were present during the exercises of each day, and discoursed excellent music whenever requested.

The slow mule race was a successful feature, affording much sport for the younger persons, and many older heads shook with jollity at the unique performances of mule and rider in their attempts "to go or not to go."

The citizens' purse of $50, for the best base ballists caused a long, earnest and very evenly contested game, and proved an attractive feature. Whatever else might be going on, those ballists during the whole afternoon of the second day were deaf and blind, save to the actions and calls in their own game.

The total receipts of the fair were	$1,139 40
Total paid out on premiums	707 90
Balance	$431 50

This balance added to a balance on hand before the Second Annual Fair, together with some paid up stock of new members, making a total of $1,348 20, from which was made another payment on purchase of fair grounds of $500 00, leaving a balance of $848 20, from which was paid out in defrayment of expenses of Second Annual Fair, exclusive of premiums, $841 16, leaving a balance in the treasury of $7 04. The liability of our association at this date, is the balance yet due upon the puchase of fair grounds, viz: $1,340.

While this association has been of some practical benefit to our county, it should be out of debt in order to accomplish the greatest good. If still more of our farmers will give us their earnest co-operation, we can soon become a more beneficial and permanant institution of the Southwest.

The annual election of the board of thirteen directors was held on the 7th of January, 1871, with the following result:

Maj. A. J. Bahney, Maj. Josiah Tilden, Col. John D. Allen, Judge John Hornback, Wm. M. Collings, Wm. Motherspaw, A. M. Drake, A. J. Blood, M. G. Skinner, Jesse Thacker, George Wolf, John R. Cabiness, A. V. Page.

On the 21st inst., the new board elected their officers as follows:

Wm. M. Collings, President; Judge John Hornback, Vice President; Major A. J. Bahney, General Agent; Wm. P. Davis, Treasurer; E. P. Searle, Corresponding Secretary.

They also changed the name of the association to "Jasper County Stock and Agricultural Association," and fixed the time for our next annual fair on the 3d, 4th and 5th of October, 1871. Our officers seem determined to make our next fair a still greater success, and will spare no labor that can assist in accomplishing that object; all of which I hope to be able to report to you in a less hasty manner than this has been prepared.

I have the honor to remain, very respectfully, your obedient servant,

E. P. SEARLE,

Corr. Se'y Jasper Co. Stock and Agricultural Association.

JANUARY 23, 1871.

JEFFERSON.

Chas. W. Murtfeldt, Esq., Corresponding Secretary State Board of Agriculture :

Dear Sir: I have the honor to send you a report of the Fourth Annual Fair of the Jefferson County Agricultural and Mechanical Association, held at DeSoto, Iron Mountain railroad, August 30 to September 27, 1870.

I am happy to be able to state, that our last fair was a success. After several years difficulty and embarrassments, our fair of 1870 was an interesting feature as well as in pecuniary matters a complete success, so much so, that we had to have a gang of carpenters employed during the fair to build more stalls, etc., and then could not quite accommodate all exhibitors.

There have been a great many improvements made previous to the fair, at which the ground had a very pleasing appearance.

Our former fairs being partly failures, the entire burden laying on the shoulders of a few men. Our honorable county court made a very liberal donation of $300 00 to the association, which enabled them to improve the ground.

Fortunately the ice is now broken, people begin to see that these institutions are a real benefit to them. We shall be able to make the necessary enlargement of our grounds for the next fair out of the proceeds of last fair. If the people of Jefferson county continue to take an interest in the institution, it will repay them both directly and indirectly. Our premium list footed up over ($1,700) seventeen hundred dollars this year, and will be yearly increased in proportion to the interest taken by the people. There is a remarkable difference visible already in regard to all kinds of stock at present in comparison to former times. Sharp-backed and pointed nosed pigs, cows and horses, more suitable for hatbands, (?) than anything else, have about all disappeared and made room for better stock.

The capital stock of the association is $4,500 00, held by thirty persons. Stock is in demand since last fair.

NUMBER OF ENTRIES IN THE DIFFERENT DEPARTMENTS, 1870.

1st department—Horses and mules	220
2d and 3d department—Cattle, hogs and sheep	95
4th and 5th department—Dairy and pantry, wines, fruits and flowers	192
6th department—Farm and garden	71
7th and 8th department—Lady's handywork, textile fabrics	170
9th department—Manufactures	63
Special private premiums	87
Entire number	902

Owing to the failure of fruits, that department made a very poor show in comparison to former years, when the fruit department was always the most interesting, as Jefferson county is a fruit-growing county second to none.

Hoping to be able to send you a favorable report of our next fair,

I remain very respectfully yours,

GUSTAVUS HAMEL,

Secretary Jefferson County Agr. and Mech'l Association.

DESOTO, Mo., November 28, 1870.

WASHINGTON.

POTOSI, Mo., January, 1871.

Chas. W. Murtfeldt, Corresponding Secretary, State Board of Agriculture:

DEAR SIR: I have the honor to submit herewith for consideration of the State Board, and in compliance with my prescribed duties as Secretary of the Washington County Joint Stock Agricultural and Mechanical Association, the following report for the year 1870:

As premised in my report for the previous year would be the case, the preparations for the fourth annual fair of our association had received such careful and untiring attention on the part of the board of directors as to render it in all respects a marked and gratifying success. All doubts previously entertained of its perpetuation as a self-sustaining institution have now been removed, I think, and the association is certainly entitled to rank, in this respect, with that of any other county or district, within my knowledge, in the State. As the liberal attention paid to our fourth annual fair by the Press of other parts of the State has already rendered public the interesting details of the exhibition, I need not here make more than general reference to them.

FOURTH ANNUAL FAIR.

The departments comprising displays in textile fabrics, agricultural implements, mechanical productions and minerals were in all respects up to the high standard heretofore attained; especially, however, in the last named of these departments was the exhibition far in advance of that of either of our preceding fairs. This branch of the exhibition was wisely entrusted to the superintendence of Jos. E. Ware, Esq., an experienced and highly accomplished practical mineralogist. Extraordinary pains were taken by that gentleman to make a thorough and creditable collection of specimens, representing the truly wonderful mineral resources of our county. The cabinet formed by Mr. Ware was, two weeks later, transferred in his charge to the appropriate hall of the St. Louis Agricultural and Mechanical Association, and there brought into successful competition with those collections which have been much longer in their preparation, and which represent in their composition a liberal expenditure of time and money.

The display in the products of farm, garden, vineyard and house (under the superintendence of Captain Fred. Will) was excellent, and the competition in it made highly satisfactory by the labor of very competent awarding committees.

In the live stock departments great interest was manifested—unusual pains having been taken by the directorate to induce owners and breeders of fine stock to be present and actively enlisted in competition. The number of fine horses in the several classes were especially noticeable, and indicative of a determined disposition on the part of the yeomanry of the county to keep full pace with an age of progress. In addition to those named in my previous reports, I beg leave to make especial mention of a fine yearling stallion colt (the property of Frank Harris, Esq., of this place), sired by Col. Colman's Abdallah, Jr. Our neighbors of Jefferson county also contributed largely to the exhibition in this as in other departments.

In the cattle department a degree of excellence was attained far in advance of our previous fairs. Several thorough-breds and some very fine high graded cattle mark a new era in stock raising in Washington county. The Messrs. Harris, of Libertyville, St. Francois county, were present, with a very fine representation of their excellent stock farm, and contributed greatly to the display.

But little improvement on the previous year was to be seen in the department of sheep; and the same may be added, with a few commendable exceptions, with reference to mules. In the hog department the exhibition was truly excellent. Several of the stock raisers of our county have secured fine specimens of the improved breeds. Among those that have come under my immediate attention during the year, I would call especial attention to the stocks of Messrs. Wm. Riehl and Frank Harris. The former, an expert in this field of improvement, devotes his entire attention to the breeding of Berkshires. He has some excellent stock, purchased recently of Mr. Snell, of ———, Canada, as well as from the most approved of Kentucky hog breeders. Mr. Harris has a variety, embracing the Berkshires, Chester Whites and Poland Chinas. The farms of our county are being supplied rapidly from these sources, as also from the well appointed stock farm of Mr. Adam Taylor, a few miles from the county seat. Of these departments I may have occasion to particularize more at some future opportunity.

IRON MANUFACTURE.

The furnace of E. Harrison & Co., at Irondale, manufactured during the year 1870, four thousand four hundred tons of pig iron. A proportion of ninety-five per cent of ore used by this company is obtained from Iron Mountain. By reference to my report of the preceding year's operations, it will be seen that there has been a marked falling off in the productions of this establishment during the year just passed. In 1869 this company manufactured seven thousand five hundred and forty tons—the past year's productions aggregating a little less than sixty-five per cent. of that amount. This difference is to be accounted for, in great part, by the fact that during the first three and a half months of the past year, the furnace was idle, during the progress of extensive and costly repairs, rendered necessary by the wear and tear of almost uninterrupted operations during the past ten years. It is now in full operation, with prospects of a very large year's work. This is an important interest of the county, giving employment, directly and indirectly, to very nearly two hundred hands.

PROSPECTIVE SILVER MINES.

Deep interest is felt in the investigation now in progress in test of an ore found upon the land of Hon. John Evens, of Hopewell, in this county, and which is pronounced by experienced, practical miners to be a valuable quality of silver ore. It is found in a dark gray quartz, and so far as tests have been made with it, is said to contain one and three-fourths per cent. of silver. Average specimens are now being submitted to ample tests, and the results of which investigations will be duly reported. The mine is located on Flat creek, in section fifteen, township thirty-six, range two east, about eight miles distant from Potosi, a little south of east. May not the celebrated Potosi silver mines of Bolivia have their parallel in our own rich mining State?

THE ZINC INTEREST

is prosperous, the shipments of the past year from one mine—that of Mr. J. S. Deggendorf—aggregating seven hundred and sixty tons. The ore is shipped from Hopewell depot in this county. Another valuable zinc mine near Potosi, is now being worked with a good degree of success, and furnishing steady employment to a considerable number of hands. The average shipments of zinc ore, at present, from Potosi depot, is about ten tons per week. All the Washington county zinc ores find a ready market in the recently erected furnace at South St. Louis.

LEAD MINING AND SMELTING.

The following is a statement of the lead manufacturers of our county for the year 1870, so far as I have been able to collect them—the furnaces unreported being generally those which do a comparatively small business :

Proprietors.	Location.	Pounds.
Wm. Long	Old Mines	2,671,250
St. Louis Lead Mining Co	Kingston Furnace	437,040
James Long	Potosi	342,580
F. Desloge	Potosi	297,635
J. & J. Lalty	Cadet	250,440
Missouri and Pennsylvania Lead Co	Harmony	243,327
John Evens	Hopewell	220,000
Teasdale & Co	Potosi	146,633
Thomas S. White	Old Mines	82,721
Total pounds lead		2,691,626

It will be found upon comparison of the above figures with my corresponding report for the year 1869, that there has been a slight decrease of the amount of lead manufactured in our county during the year 1870. Including the productions of the remaining furnaces unreported here, the lead manufactured in our county during the year 1870, will amount to something over three millions of pounds—more than one-fourth of the entire amount estimated by Professor Hager, State Geologist, to have been manufactured within the State during that time.

BARYTES OF LEAD, OR "TIFF,"

in its mining and preparation for market furnishes occupation to a large number of people in the county, and our annual trade in it may be said to increase correspondingly with the increased extent to which our lead mining operations are carried on. This article is in good demand, being at this time, I believe, used in the adulteration of seven or eight different articles of importance in the commerce of the nation.

YELLOW PINE LUMBER.

Is still an important item of manufacture and export with our people, although I am unable at this time to furnish you with statistical information of its extent. During the year 1870, the shipments of lumber (principally pine) from Potosi alone, of the several depots in our county, aggregated nine million one hundred and twenty-six thousand feet; against shipments during the previous year, of nine million nine hundred and ninety-seven thousand feet. From the constant operations of twenty saw mills in the county, those of our pineries most accessible to the several railroad depots of the county, have been to a great extent cut out, and several mill owners have consequently been induced to seek more inviting fields for their operations in the extensive and hitherto uncut pineries south of us. In addition to the Potosi lumber shipments given above, I can only give those from Hopewell depot, aggregating very nearly four hundred and seventy thousand feet.

In view of the decrease in this branch of our industrial occupations, we can only look with renewed hopefulness to the other branches, yet unaffected in their extent by the operations of years past.

THE AGRICULTURAL PROSPECTS

Of the county are materially brightened with the prospective eastern extension of the Fort Scott and Laclede railroad, which it is thought will pass for a few miles through that very rich and productive section known as the Bellevue Valley. Such an additional market communication would be of great value, and its encouragement by the community to be more immediately benefitted by its projection, will no doubt be commensurate with its importance to them.

Respectfully submitted,

GEO. B. CLARK,

Secretary Washington County J. S. A. and M. A.

FARMERS' CLUBS.

PIKE COUNTY FARMERS' CLUB.

LOUISIANA, Mo., February 18, 1871.

C. W. Murtfeldt, Corresponding Secretary Missouri State Board of Agriculture:

DEAR SIR: This club was organized in this city on the 18th day of last June, and now numbers about forty members.

Section two of the Constitution defines the objects of the club to "be the acquiring and diffusing of a practical knowledge of the sciences of Agriculture and Horticulture in all their varied branches, and the seeking out and application of all such means as will tend to develope, advance, protect and sustain the best interests of the rural classes."

Its officers consist of a President, Vice President, Recording Secretary, Corresponding Secretary and Treasurer, who are elective at the first meetings of the club for the months of January and July, and hold their offices for six months. They also constitute the Executive Committee during their terms of office.

The officers for the present six months are William Stark, President; A. McMoore, Vice President; R. E. Pleasants, Recording Secretary; A. J. Reid, Corresponding Secretary, and Samuel O. Minor, Treasurer.

The constitution establishes the following as the regular exercises (unless specially suspended) to wit: "Discussions, Essays, Lectures, Questions, Answers, and any other exercises properly pertaining to the objects to be attained by the club; and to this end it makes it the duty of the President, at each meeting, to appoint members to lecture, and others to write essays, upon special subjects."

The club meets at its room, in this city, on the second and fourth Saturday's of each month, and the order of business is as follows:

1st. Roll call.
2d. Reading journal of last meeting.
3d. Regular exercises.
4th. Voluntary contributions.
5th. Unfinished business.
6th. New business.
7th. Adjournment.

Speakers are confined to three speeches of not more than ten minutes each, upon any one subject at the same meeting of the club, unless by consent of a majority of the members present.

The annual fee of membership, is only fifty cents. All members are required to perform all duties assigned to them by the club. Failing to do so, unless for good cause shown, they are subject to a fine of not less than twenty-five cents and not more than one dollar, as the club may determine.

The above is a full outline of the organization of the "Pike County Farmers' Club."

Since its organization many subjects have been discussed with profit to its members. Prominent among them are the following: "the best kinds of wheat to cultivate," "the best mode of putting it in," "the best quality of soil for the various kinds of wheat," "the stock law," etc., etc., and now the club has a special committee circulating petitions, praying the Legislature, at its present session, to enact a stock law similar in its provisions to the one drawn up by Colonel N. J. Colman, and also for a law imposing a tax of not less than one dollar upon each dog kept in the State.

Very respectfully yours,
R. E. PLEASANTS,
Recording Secretary.

JEFFERSON CO. FARMERS' AND FRUIT GROWERS' CLUB.

FRUIT DALE, DESOTO, JEFFERSON CO., MO., November 26, 1870.

C. W. Murtfeldt, Corresponding Secretary Board of Agriculture:

DEAR SIR: Resuming the task again to present you a report touching agricultural and horticultural progress in Jefferson county for 1870, I do so with no little diffidence, and perhaps I may be pardoned if I say, also considerable reluctance owing to the fact that our progress has been very meagre, and hence any report setting forth a true state of facts cannot be very encouraging.

The spring of 1870 opened propitiously, and the usual alacrity of our farmers and fruit-growers was manifest in preparing and providing for a bountiful season. Alas! the best endeavors, hopes and energies are sometimes blighted, and so it proved this year. Fruit trees of almost every variety put forth their buds early, and blossomed profusely, affording one of the most lovely pictures the eye ever beheld, and alluring us with the bouyant hope of a bountiful yield, but by some unaccountable freak in nature, or from some cause beyond the ken of human wisdom, old *Boreas* took umbrage at our prospects, and with one of his chilling blasts and rather boisterous embraces, cut off at one fell swoop all our hopes, based three feet and upwards above the soil, hence the peach, apple, pear, gooseberry and currant are to us among the things that were. There may have been a few favored localities in the county that could boast of a few winter apples, but generally the above is true.

Strawberries were especially favored, and afforded a very fair yield. Blackberries and raspberries bore abundantly, but after the first and early picking, the berries were dried up by the hot and dry weather now intervening; and as calamities seldom come single-handed, we have now to record an excessive drouth, which seriously affected all of our product. The tomato, though blooming well, could not fruit, and the tassel of early planted corn was deprived of fertilizing power, by being burnt up, or blighted for want of moisture. The later planted corn fared better, and has proved an average crop. Later in the season we were blessed by one or two refreshing rains, just in time to save our principal corn crop. This gave a new start to vegetation, but was too late to render any aid to the grain or grass product, hence hay was little more than a half crop, and oats, rye, etc., still worse.

While we are now thinking of oats, it may not be out of place to refer to the comparative merits of the Norway and other oats. The experience of the writer is decidedly in the favor of Norway oats. With him, and in fact, in this whole county, as far as heard from, this variety was the only one that withstood the drouth, and that only in a measure. Sown side by side, or in proximate conditions of soil, with the common and Surprise oats, they far outstripped them in growth and yield; still not up to the standard of their previous reputation. I sowed two bushels on two acres of ground, and harvested eighty bushels, and I have no hesitation in saying that, had the season been good, *ordinarily*, the yield would have been double. At any rate, with us here, the yield was double that of the common oat, and fully one-third more than the Surprise. In weight, however, bushel for bushel, the Surprise has the advantage, but not sufficient to counterbalance the excess of yield.

Grapes have been very good, and fully an average crop. Early in the season, traces of rot were visible in the Concord, Hartford Prolific, and Catawba, but its duration was brief. The Catawba, for the last two years has been comparatively free from mildew, and is giving encouragement for better expectations, so much so, that some of our vine-dressers are taking measures to plant more extensively of this grape. The inducement to this step lies in the superior character in this grape for wine, and the greater demand for it in the market. To make the Concord into wine, is far from encouraging to the vintner, as the market seems to be overstocked, and its reputation is somewhat below standard.

We have to record still another calamity in the character of the fall "Army Worm," which has been very destructive, leaving no vegetation that required the fostering hand of the cultivator, untouched. They laid our fall pastures bare, punctured tomatoes as they ripened, producing rot; took corn by storm, and when they found any of the sweet varieties, as happened with the writer, they completely stripped it of its leaf, and then took the ear and bored it through and through, producing total ruin. Scarcely an ear, but in it would be found from two to six worms rapaciously feeding and fattening therein, then finally, laying siege to the turnip, in which their rapacious appetites being appeased, they *left:* for *where?* Say! friend Riley, where? Surely, the cultivator of the soil is beset by contingencies on every hand! And where is the remedy? Will a better knowledge of science enable him to overcome these difficulties? Can he by the study of *isothermal* and *thermal* changes, know *how*, *when* and *where* to plant, so as to avoid chilling blasts, biting frosts, or burning drouths? Can he, by a thorough knowledge of entomology know how to rid his product of the myriad pests that now infest him with surer destruction than a legion of men in arms? Surely, the end to be gained is worthy of the effort. Here then is a strong incentive to, and a powerful argument in favor of hastening the benefits to be derived from our State Agricultural college, that our youth who will ere long take our places, may be the better prepared for the task. The importance of this, to the agricultural community, not only demands the active operation of this institution, but that its professors and instructors should be thorough in their professions, and capable to instruct, and there should be no parsimony practiced in the matter of remunerative salaries, not only to demand the best talent, but to encourage it, and secure the best possible results.

The "Jefferson County Farmers' and Fruit Growers' Club" have again resumed their sessions, and are fully alive to the leading questions of the hour, touching legislative action, viz.: The "Stock Law" and the "Dog Law," or "Protection to Sheep Husbandry." It is the unanimous decision of the club, the time has come for the hog to be restrained from depredation, and that A.'s ox should no longer be allowed to trespass upon B.'s domain without his consent.

Sheep husbandry has been discussed, and its adaptation to this county fully indorsed; but without some protection from the ravages of dogs, it is wholly impracticable. At a meeting held in July last, the club appointed a committee, consisting of Messrs. B. S. Reppey J. J. Squire and Col. L. J. Rankin, to draft resolutions with a view to petition the next Legislature for due protection in the matter. This committee reported and recommended for the favorable consideration of the club the act passed by the Legislature of New Jersey, "defining the legal status of the canine species, and levying a State tax upon the owners of the same," as amply meeting the case, which was adopted entire excepting that part of section 1 where the owner of every dog shall be taxed $2, and the owner of every bitch $3. Instead thereof they recommend a tax of $1 for a dog and $2 for a bitch. In all other respects they indorse the act, and respectfully recommend it to the favorable consideration of the State Board of Agriculture for the State of Missouri, for joint action, to present to the next Legislature, praying that it may become the law of this State.

The reason adduced for changing the amount of tax was in this consideration: that as the people of Missouri had never been subject to such a tax, it would be unwise to make it too heavy, as by so doing the law would become obsolete, and the tax could not be collected. They aver that the tax should be no higher than necessary to meet the case, and furnish that protection for which the law is designed.

It is hoped, also, that other clubs and agricultural associations in the State will unite their efforts with the State Board to induce our Legislature to legislate for the true interests of all Agricultural progress.

Respectfully,

JOHN J. SQUIRE, *Cor. Sec'y.*

REPORT OF THE ST. LOUIS AGRICULTURAL AND MECHANICAL ASSOCIATION.

RECEIPTS AND EXPENDITURES DURING THE YEAR 1870.

The annual election for a Board of Directors of the St. Louis Agricultural and Mechanical Association was held yesterday according to previous announcement. It resulted in the election of the following gentlemen:

Arthur B. Barret, D. K. Ferguson, G. B. Allen, E. A. Manny, James S. Farrar, John J. O'Fallon, E. C. Lackland, Charles Speck, Henry Clay Hart, L. L. Ashbrook, Jeff. K. Clark, David Clarkson, B. M. Chambers.

The following interesting exhibit of the financial condition of the association, showing the result of the year's operations, by the Secretary:

RECEIPTS AND EXPENDITURES.

Receipts.

By loan and discount	$63,000 00
By premium account	5,620 00
By gate fees	66,051 40
By booth account	15,176 50
By bills receivable	3,950 00
By horse account	295 00
By expense account	300 00
	$154,392 90

Expenditures.

To new amphitheatre	$49,303 06	
To new pagoda	6,234 95	
To old amphitheatre	5,944 41	
To general improvement	5,313 26	
Total improvements		66,795 68
To real estate		20,878 96
To horse account		485 00
To furniture		61 90
To salary account		940 92
To expense account		19,828 68
To labor account		8,059 32
To cash overdrawn January 1, 1870		2,301 25
To premium account		27,577 25
To printing account		2,931 52
To interest account		2,830 88
To insurance account		1,180 00
To cash on hand		521 54
		$154,392 90

BALANCE SHEET.

Receipts.

By stock account	$82,050 00
By bills payable	96,458 83
By profit and loss	77,308 77
	$255,817 60

Expenditures.

To improvement account	$117,859 55
To real estate account	135,880 16
To horse account	540 00
To furniture account	1,016 35
To cash account	521 54
	$255,817 60

The following is the certificate of the committee:

We, the undersigned, have examined the accounts of the Secretary, and find them correct.

E. A. MANNY,
GERARD B. ALLEN,
CHARLES SPECK,
Finance Committee.

Owing to the unusual expenses incident to last year, particularly in the construction of the new amphitheatre, the association had but a small margin for actual gain, but the splendid improvements effected are in themselves permanent and profitable investments. The gate fees in 1869 reached the sum of $51,299 00, and for last year as given above, $66,051 40, showing a gain of $14,752 40.

G. O. KALB,
Secretary.

RAILROAD STATISTICS.

MISSOURI STATE BOARD OF AGRICULTURE,
OFFICE, INSURANCE BUILDING, NORTH FIFTH STREET,
ST. LOUIS, MO., 1870.

President or Superintendent —— Railroad Company:

DEAR SIR: In preparing the annual report of the State Board of Agriculture for the press, it has occurred to me that in a review of the material condition and prosperity of our State, it would be of general interest to give some data of the operations of the different railroads in Missouri.

Hoping that you, sir, will second the efforts of the undersigned, I shall be greatly obliged to you if you will instruct the proper officer of your company to answer the following interrogatories (officially), so far as it may be deemed consistent with your own views:

1. How many miles of railroad has your company in operation?
2. How many miles of this road have been constructed in 1870?
3. How many miles, if any, are now being constructed?
4. What are the termini of your road and branches, if any?
5. How many head or car loads of cattle were transported over your road in 1870?
6. What is the increase over the year 1869?
7. How many head or car loads of hogs were transported over your road in 1870?
8. How many bushels of wheat, corn, oats, etc., were transported over your road in 1870?

Any other information regarding your road and branches you may please to communicate.

By complying with this request at your earliest opportunity, you will very much oblige,

Your most obedient servant,
C. W. MURTFELDT,
Corresponding Secretary.

HANNIBAL AND ST. JOSEPH RAILROAD COMPANY.

HANNIBAL AND ST. JOSEPH RAILROAD COMPANY,
GENERAL SUPERINTENDENT'S OFFICE,
HANNIBAL, MO., December 28, 1870.

Chas. W. Murtfeldt, Esq., Corresponding Secretary Missouri State Board of Agriculture, St. Louis:

DEAR SIR: In reply to yours of the 23d, I beg to say that our fiscal year ends with the 31st of August, and our yearly reports all end with that date; consequently we cannot, without considerable labor, give the statistics asked by you for the current year.

As perhaps you know, the eastern termini of this road are Hannibal and Quincy; the western termini St. Joseph and Kansas City. We have two hundred and twenty-five miles of road, and all completed previous to 1870.

During the fiscal year ending August 31, 1870, we transported products as follows:

Cattle	85,700	head.
Hogs	130,827	“
Sheep	9,230	“
Wheat	171,323	bushels.
Corn	490,378	“
Oats	153,323	“
Miscellaneous produce	2,134,000	pounds.
Tobacco	1,171,900	“
Hemp	66,500	“
Bacon	8,414,600	“
Pork	2,038,400	“
Hay	830,700	“
Lard	2,735,200	“
Tallow	174,600	“
Hides	2,536,700	“

The number of cattle shipped during the year ending August 31 1869, was 60,380 head. Increase of 1870 over 1869, 5,320 head.

If the above figures will be of any service to you, I shall be very glad of it. I should be glad to go more into detail, but our office work is so pressing at this time of the year that we cannot attempt it just now.

I inclose pass for 1871.

Yours, etc.,
GEO. H. NETTLETON,
General Superintendent.

NORTH MISSOURI RAILROAD COMPANY.

President's Office, North Missouri Railroad Company,
St. Louis, December 29, 1870.

Chas. W. Murtfeldt, Corresponding Secretary State Board of Agriculture :

Dear Sir : In compliance with your letter of the 22d just received, I submit to you the following information, which I hope will be of use to you in the way you desire.

During the past summer the St. Louis and Cedar Rapids railroad which is operated by us, was completed to Ottumwa, Iowa, from Bloomfield, a distance of twenty miles. Early in the fall arrangements were made by which the St. Louis and St. Joseph Railroad was completed and placed under the management of the North Missouri.

This road extends from Lexington to St. Joseph, crossing our line at Lexington and Richmond Junction, and is seventy-two miles in length.

By the end of this month the road from Brunswick, on our west branch, to Chillicothe, Mo., will be completed and placed under our control, adding thirty-four miles to the road operated by us. Thus the termination of the present year will find five hundred and thirty miles of road under the management of the directory of the North Missouri, Railroad Company, as follows:

From St. Louis to Kansas City	273	miles.
From Moberly to Ottumwa	130	"
Columbia Branch—from Centralia to Columbia	22	"
St. Louis and St. Joseph Railroad	72	"
Brunswick and Chillicothe Railroad	34	"
Total	530	miles.

One hundred and thirty miles of which has been constructed during the present year.

The road from Brunswick to Chillicothe is but the commencement of the St. Louis, Council Bluffs and Omaha Railroad, which is already graded thirty-eight miles beyond Chillicothe and will undoubtedly be finished to Omaha, a distance of one hundred and seventy-two miles, during the coming year, thus placing St. Louis one hundred miles nearer Omaha, and forming with the Union Pacific Railroad a grand trunk line to the Pacific, shorter and more direct than any route yet built or contemplated.

The amount of freight handled by the road during the past year is shown by the following exhibit:

Merchandise forwarded	342,161,001	pounds.
Merchandise received	314,906,318	"
	657,067,317	pounds.

Cattle	50,092	head.
Sheep	32,870	"
Hogs	95,441	"
Horses and mules	2,166	"

Grain receipts—

Oats	190,699	
Corn	327,954	
Wheat	346,875	
Barley	35,205	
Total bulk grain	900,733	bushels.
Total in sacks, grain	1,087,084	"

I regret that I have not at present near me the information which would enable me to make a comparative statement of these receipts with those of the previous year. But as such statistics are not now in my possession, and as you are in immediate want of this information, I must present the matter in its present incomplete form. The earnings, which I give below, will show, however, that there has been a remarkable increase in the business of the road for the past year—a satisfactory indication of the permanent settlement of our State and those adjacent to it, with a large and ever growing population, looking upon our city as their base of supplies.

Freight receipts from Dec. 1, 1868, to Dec. 1, 1869	$1.065.863 87
Freight receipt from Dec. 1, 1869, to Dec. 1, 1870....	1,663,857 95
Increase..	$595,094 09
Passenger receipts from Dec, 1, 1868 to Dec. 1, 1869 ...	$864.579 21
Passenger receipts from Dec. 1, 869 to Dec. 1, 1870....	1,127,623 43
Excess..	$263,042 44

Or an increase in our present year's business of over fifty per cent. on freight, and over thirty per cent. on passenger business.

The bridge over the Missouri river at St. Charles, has been delayed in building by unforseen obstacles, but is now rapidly approaching completion. Completed the great difficulties against which we have had to contend, arising from the uncertainty of the river crossing will be removed.

Thus yearly the North Missouri Railroad is increasing in magnitude, its branches extending more and more through every portion of North Missouri, its termni located not only in the extreme limits of our own State, but seeking a resting place in Iowa or within the distant boundary of Nebraska, developing in its onward stride the great resources of the State in which it has its birth and forming an able and all important ally to your association in the great work in which you are engaged.

Respectfully,
JAMES F. HOW, *Secretary.*

PRACTICAL PAPERS.

CULTURE OF THE POTATO.

ESSAY READ BEFORE THE MADISON COUNTY FARMERS' CONVENTION,

BY S. B. JOHNSON.

Very few cultivators give the importance to this vegetable which fairly belongs to it. In the plans for the season a large area is given to corn; perhaps a still larger to wheat; and oats occupy no mean place, particularly if the seed commands a fabulous price. If perchance some little out-of-the-way corner yet remains unappropriated, the force which has well nigh spent itself on the important crops is allowed, on some leisure Saturday evening, to finish itself in the potato patch—and too often the patch itself is finished at the same time.

The corn ground is prepared with the utmost care. You know almost to a mathematical certainty the distance the rows are apart and the points of the compass to which they run; the number of hills in a row, and the grains in a hill; and how many shoot up and make a stand. Should there be one too many stalks in a hill, out it must come at the proper time. It is harrowed and cultivated, thinned, recultivated, plowed and "laid by" just when it should be.

When we hear of one crop of potatoes managed with similar care and patience, is it not the exception rather than the common practice? We could cite cases where, year after year, the owner was glad to get his potatoes dug on shares; and the luckless wight who took the job made beggarly wages at that. With such results staring them in the face it is little wonder that these men say "potatoes don't pay." Why not? The corn, wheat and oats made good crops; the soil best adapted to them was selected; they were properly put in and properly cared for; a handful of corn was not allowed to grow in a hill, nor was it "laid by" in such a wilderness of weeds that one might lose his way in attempting to follow the rows.

It is not true that we do not fully appreciate the value of this crop? It stands side by side with wheat and corn—perhaps the third in importance of our great articles of national food. In 1860 there were 150,000,000 bushels of potatoes raised in this country. It is no exaggeration to estimate that in 1869 the product reached 200,000,000 bushels. At fifty cents per bushel, the value would be $100,000,000

While this crop stands third in importance as an article of food with these great staples, as a source of profit to the producer, it stands pre-eminently at the head and above them. You shall have no random statement for this, but figures, a logic which it is hard to evade. What say the statistics for the years 1862, '63, '64 and '65?

States.	Corn.	Wheat.	Potatoes.
Maine	46.52	25.48	69.79
New Hampshire	42.87	30.77	67.77
Vermont	48.80	29.03	59.72
Massachusetts	43.03	33.02	81.94
Rhode Island	43.46	30.87	88.89
Connecticut	40.22	32.57	80.37
New York	32.04	26.10	57.99
New Jersey	37.30	28.28	68.46
Pennsylvania	32.20	23.93	72.30
Maryland	24.19	21.73	58.45
Delaware	19.82	22.74	92.04
Kentucky	21.14	16.25	71.25
Ohio	20.20	16.25	64.83
Michigan	22.93	21.10	52.35
Indiana	17.96	16.30	59.26
Illinois	14.47	14.36	60.13
Missouri	17.81	18.75	60.46
Wisconsin	20.31	14.63	50.51
Iowa	19.59	12.85	54.91
Minnesota	20.43	13.16	58.40
Kansas	20.52	21.67	82.88
Nebraska	27.82	23.91	98.45

Here in our own proud State, the granary of the world, the average cash value of corn per acre for four consecutive years, is $14 47; of wheat $14 36; while that of potatoes is $60 13—more than three hundred per cent. in favor of the latter. Let it be remembered, too, that this was in war times when the prices of the cereals were considerably enhanced.

THE SOIL AND ITS PREPARATION.

With us the best results have been secured on the second bottom of a creek, running through the place. The land is high, dry and rolling. The soil, a sandy loam; subsoil a porous yellow clay. Is not easily affected by extremes of wet or drouth. About ten acres of it had been in cultivation for fifty years. The humus was exhausted, consequently an essential ingredient was wanting for the potato. We seeded the field down to clover in the spring. The following year the clover made a good growth. The first crop was cut for hay. The after-crop, when matured, was well plowed under late in summer. The following spring planted to potatoes.

The poorest part of it produced at the rate of three hundred bushels per acre.

The plowing under of any green crop—we prefer clover—will add to almost any soil the essential ingredients to the growth of the potato. Low, wet or argillaceous soils should be the last resort. A large crop is often produced on low bottoms, but the quality is inferior. Take your stand on the corner of the streets of the chief market towns of this county on a day when potatoes are coming in by the wagon load. The first question the grocer puts is, were they raised on the bottoms or upland? If the latter, they will bring ten or fifteen cents more per bushel—an aggregate of from $4 to $5 on the load—a difference sufficient to pay for marketing them. Men do not care to be taxed for extra water in a potato more than in milk.

In many localities it would do to recommend a liberal supply of superphosphates, guano, wood-ashes, etc., but with us, in most cases, it would not be practicable, nor is it necessary to a good paying crop. With such soil as has been recommended, if it be much worn and the necessary humus is wanting, green crops turned under and rotted will renew the soil. When the ground is sufficiently dry in the spring start the plow, running from ten to twelve inches deep. If the subsoil is stiff, tenacious, the subsoil plow will be advantageous. Pulverize thoroughly with the harrow, and you are ready for planting.

WHEN TO PLANT.

It is now a well accepted fact that the earlier we can plant in this latitude the better. If the ground is sufficiently dry in March, even on the first day, let the work be commenced. We cannot disguise the fact that, with a soil unsurpassed, we labor under greater difficulties with this crop than they do in more northern and eastern localities. The potato rejoices in a cool, equable, not too humid, climate. The drouths, which are the rule rather than the exception here, often set in at a time in early summer to result most disastrously —if the planting has been delayed to the latter part of April or into May, frequently killing the tops outright when the tubers are not half grown; or, if the plant survives, the growth of the root ceases for a while. With the cessation of the drouth, a second growth commences and the tuber sports itself in all sorts of shapes, nearly ruining it for the table and market. By early planting, nine times in ten we escape this disaster.

WHAT TO PLANT.

If we have no variety that can be planted early and will stay with us through the winter, it is our misfortune; and, as a *dernier* resort, we will supply our Northern neighbors through the summer, and they shall return the compliment in the winter; but are we driven to this alternative?

All remember the alarm created by the potato disease in Europe in 1843. Sorts which had been tested for years and had always been reliable, failed. Strong men, helpless women and children in Ireland actually died of starvation, such was the famine produced by the failure of this crop. The loss to Great Britain in one year was estimated at fifty million dollars. A plague similar to it spread to this country, and our losses from that source alone have been placed at six million dollars or more in a single year.

We cannot do better than to quote here the author of the "Potato Mania. In speaking of Rev. Chauncey E. Goodrich, of Utica, N. Y., chaplain of the N. Y. State Lunatic Asylum, he says: "At this juncture, when men were looking on with dread at the prospective annihilation of the potato, moved by considerations of patriotism, Mr. Goodrich turned to account his habit of observation and experiment in the vegetable kingdom. Instead of seeking for the convalescence of old varieties, he believed that the true road out of the danger lay in the direction of a *renewal of the stock from original sources*—and to this, being now relieved from a pastoral charge, he devoted himself with singular intelligence and industry. The potato is indigenous to the tropical mountain regions of South America. It flourishes best on the table lands of the Andes. There is no cold or winter there, and yet the elevation makes the ground cool and moist. Mr. G., in 1843, at an expense of $200 procured some potatoes from Chili. From 1843 until the time of his death in 1863, he raised not less than sixteen thousand seedlings. There are few instances on record of zeal so disinterested, chiefly in two respects: First, in that he would not permit himself to be imposed upon in the judgment which he placed upon the merits of his seedlings, remorsely sacrificing almost the whole of them, sifting and reducing the number to some seventy, and ultimately to eight or ten, which by wide and generous distribution, he had caused to be tested over the breadth of the whole North, from Canada to Virginia; and, secondly, in that he worked out his benevolent labors to the end of his life, without turning his industry to his own profit. Goodrich was the pioneer and patriarch of the New Kingdom of Potatoes."

Of the Goodrich seedlings we have tested but two varieties—the early Goodrich and the Harrison. Mr. G. describes the former as being round to longish; sometimes a crease at the insertion of the root; flesh white; flowers bright lilac; produces many balls; yield large. This sort is No. 1 in every way. We proved it to be a good bearer, and of good quality for two seasons; the third year the quality was good for a few weeks, after which it had a sweetish, disagreeable flavor, and we have since discarded it. The Harrison also gave fine promise at the outset; yielded prodigiously, and was of excellent quality; but after the second trial we threw it aside as only fit to raise for the hogs.

From one of the other Goodrich seedlings, the Garnet Chili, Albert Breese of Vermont, originated a variety in 1861—the Early Rose—which has been tested for some years and challenges the world for a competitor. It has a stout, erect stalk of medium height; large leaves; flowers white; bears no seed balls. The tuber is quite smooth, nearly cylindrical, varying to flatish near the centre, tapering gradually toward each end; eyes shallow, but sharp and strongly marked; skin thin, tough, of a dull bluish color; flesh white, solid, and brittle, rarely hollow, boils through quickly; is very mealy, and of the best table quality. Matures about ten days earlier than the Goodrich or any other variety with which we are acquainted. Nor is this all that commends it. It is not only the earliest, and most productive summer potato, but with us has proved good for winter and spring. We know of no better keeper. Early in July of last summer we had on our dinner table samples from the crops of 1869 and '70. They were then pronounced excellent. Where can you find another variety that will remain perfectly sound, firm, and retain its flavor, the year round?

The Neshannock was once the prince of potatoes, but its glory has departed. It has lost its healthfulness, productiveness and flavor. The Buckeye or Early York, is still of fair quality; a tolerable bearer; eyes deep, and the centre is often hard. The Peachblow is a late potato; good bearer; eyes deep; flavor fine when grown on light soil; if on a strong soil, is sometimes coarse, and hollow at the heart. It is the only variety we can recommend for a late potato. The Shaker Russet is coarse, unshapely, deep-eyed, large, and few in a hill. The English Fluke is a large, smooth potato of good quality, but not successful here.

HOW TO PLANT.

Until this new era in the potato, it seldom occurred to the planter to count the number of eyes in a hill, even if he did the number of potatoes. If the seed was large, the rule was, fewer in a hill; if small, a greater number. So many bushels were left from the winter's store. Get rid of them at some rate, giving each hill a fair proportion, until the limits of the field are reached, and the store exhausted. This new era, this greenback, if not golden era, in the kingdom of potatoes, has worked a most salutary change in this respect. When a single tuber costs $50, or a valuable cow; or sixteen of them a thousand-dollar town lot, the purchaser can afford to take time to count the eyes in the potatoe. Thus, in the effort to make the most of what might seem a bad bargain, valuable facts have been evolved. To secure the greatest results from seed so expensive. it was cut close, planted thin—one eye to a piece, and one piece to a hill, were grudgingly deposited with mother earth. The lavish return she made for favors doled out so sparingly, has brought about a radical revolution in planting. Now, the question is, not how much, but how little seed shall be put in the hill. There is great diversity of opinion as to the best size for seed—whether large or small, but one eye is better than a dozen in a hill.

WHAT TO PLANT.

Be careful to secure sound, well-ripened seed, whether large or small, the condition being of vastly more consequence than the size; cut the large potato to pieces of one eye. Begin at the butt end; cut towards the centre, leaving a due proportion of the potato with each eye. Very small potatoes may be quartered, cutting from the seed to the stem. We prefer the hill method to drills. Lay off shallow furrows 3½ feet each way; place from one to three sets in a hill, as you have the ground or seed. If the eyes are perfect, you can calculate on about as good a crop from one set as three; cover with light plow or hoe from three to four inches deep; just before or after the plant appears, go over with a two-horse harrow. This is better than two plowings for keeping back the weeds. When about three inches high, with a one-horse Diamond plow, run close to the hill to the depth of five or seven inches, throwing the dirt from it. Go through each way in this manner. By this time the plant is six inches in height.

Now take a large plow and throw the soil back to the hill. A two-fold object has been gained by this process. The seed is slow at first in starting. The soil has packed in and about the hills. Now you have broken the incrusted surface, loosened the soil, warmed and given new life to the sluggish plant. The tubers have a soft, mellow, roomy bed, in which to grow and mature. No further stirring of the soil is needed. Whenever the potato has commenced to blossom, it should be left undisturbed. Every additional stirring causes new tubers to set, and, as a consequence, you get a disproportionate number of small, immature potatoes. Should any weeds appear among the hills, pull them out by hand.

THE POTATO BEETLE.

The vicissitudes of the seasons—noxious weeds—even the terrible rot—are not at present the worst enemies of the potato.

According to entomologists, there are ten different species of insects that prey upon the potota plant in the United States. The stalk borer, potato stalk weevil, potato worm, striped blister-beetle, ash-gray blister-beetle, black-rat blister-beetle, margined blister-beetle, three-lined leaf-beetle, cucumber flea-beetle, and the Colorado potato bug (*Doryphora* 10-*lineata*).

Nine of the insects named we shall not stop to notice, for they are pretty well cared for by their parasites. But the last named—the Colorado beetle—has proved to be more than a match for its parasites, and has too often out-generaled the strategy of man himself.

The lamented Dr. Walsh estimated, some two or three years since, that in the northwest alone, this bug had damaged the potato crop to the amount of $1,750,000! It came from the Rocky Mountains, where it was found forty-five years ago, feeding on a wild species of potato peculiar to that region. As the potato began to be cultivated there, this pest soon acquired a taste for it. It started on its eastward march, from potato patch to potato patch, at the rate of sixty miles a year. It now holds the country from Indiana to the Rocky Mountains.

A detailed description is unnecessary here. You all have, doubtless, made his acquaintance the last season. It might sharpen the courage somewhat for the coming campaign, to refresh the memory for a moment with an allusion to its almost limitless resources. According to Dr. Shimer, each female lays about 700 eggs. In six days the eggs hatch into larvæ, which feed on the foliage of the potato plant about seventeen days; they then descend to the ground, where they change into pupæ at the surface of the earth. The perfect beetle appears about ten to fourteen days after the pupa is formed; begins to pair in about seven days, and on the fourteenth day begins to deposit her eggs. There are three broods every year. If you can count the stars in the heavens, then perhaps you can calculate the number of the army that, now safely burrowed in "winter quarters" in the ground, is making ready to sweep over our potato fields the coming season.

For two or three years previous to the last, they have visited us in small squads. Even in 1869 it was thought that their parasites—the lady-bug and others—could, and did take care of them. But in 1870 they came upon us like an "extinguisher on a rush-light." Those who were prepared for them, by close attention, saved their earliest planted fields; but thousands of later planted fields were stripped of all their green beauty, and the naked, blasted vines abandoned to the destroyer. Any of the ordinary appliances for destroying them were of no avail. To undertake to catch them in tin pans and burn them, as had been done, would be of no more avail than to go through one of your extensive peach orchards with a doll's china cup to capture the curculio.

How are we to save ourselves from this scourge? The little corner patch of an acre or so can be managed on the tin pan and fire plan. But here are 20, 50 or 100 acres in a plantation; we know of only one way in which it has been done effectually on a large scale: that is by the use of *Paris green.* This is a most virulent poison, and must be used with the utmost care. Secure the best. It can be purchased by the canister (14 lbs.) for 45 cents per pound. Puncture the bottom of a quart tin bucket with holes about the size of bird-shot; solder midway on the side a handle with a socket three or four inches deep, into which thrust a stick four feet long; having muffled nose and mouth, mix thoroughly one part of Paris green with eight parts of gypsum. With this long-handled bucket, and by keeping on the windward side, the muffler can be removed, and you may march with safety into the battle-field. Commence as soon as the plants appear, and dust every hill thoroughly. Go over the field twice a week, if anything in the shape of the bug is to be seen. It may be disguised by countless myriads in the yellow eggs lain on the under side of the leaf; and some day, when least expected, the naked, defoliated stalks are reeking with the filthy larvæ. By the use of plaster instead of flour, a stimulant is employed of great value to the crop. After the bug is vanquished, it would be of advantage to continue the application of the plaster until the crop is ripened. The

DIGGING AND STORING

Is not a difficult affair. With a four tined potato fork, a hand can dig from 20 to 40 bushels per day. Place the potatoes in convenient piles as they are dug, and cover with the tops to keep from the sun. Place in a cool, dry cellar, or bury in pits. They keep best buried. Put in piles, say four feet at the base and three feet high. Cover with six inches of straw and about six of the soil. Corn fodder evenly set up over this will be an excellent protection from rains and frost.

They should be covered only lightly, until winter is about to set in for good. The half of a sheaf of straw tightly bound in two or three places should be set in the centre of each heap—like a smoke stack—to act as ventilator and carry off surplus heat or moisture. In very cold weather, additional protection may be given by placing more straw at the top.

If potatoes are buried in heaps, care must be exercised to thoroughly drain off the water. Potatoes intended for the table in early spring should be kept in a cool, dark chamber, to prevent sprouting.

PLOWING AND DRAINAGE.

AN ESSAY READ BEFORE THE MADISON COUNTY FARMERS' CONVENTION.

BY C. W. FANGENROTH.

Mr. President and Gentlemen: The subject of plowing and drainage being assigned to me by the committee on the programme for the present farmers' convention, it is with great reluctance that I present my views before you at this time, knowing my inability to do the subject justice—for my experiments have taught me that plowing and drainage is the most important work to be done by the tillers of the soil in every country and in every clime; and in proportion as the correct principles of plowing and drainage have been carried on and practiced by the farmer, we find success and profitable crops have more generally been the result than when but little attention was given to them. As plowing has been, and will be in all time to come, the most expeditious mode by which the ground is first fitted and put in condition to receive the many different seeds of plants and trees, it becomes our duty as a progressive people, to do the work well

Furthermore, the improvements made in the construction and manufacture of the plow, from the ancient forked stick of the Egyptians, with which they formerly stirred (or rather tickled) their ground, to the plows of the present day, which are constructed upon tested scientific principles, is a very great step, and a comparison will prove to the most superficial observer that no implement used by the farmer is deserving of more attention and importance than the plow. Many of you, no doubt, remember the ill-shapen and poorly-constructed things of thirty years ago, to say nothing of centuries before them. In examining some of the records of the improvements made, I find that in the beginning of the last century the mold-board first used was made of wood; next it was covered with sheet-iron to prevent its wearing out too soon. At the beginning of the present century cast-iron plows were invented, and by 1810 that plow was found in general use in the older States. But in opening up so vast a farming country as the great West, a new impetus was given to the manufacturing of farm implements. Among these the plow manufactories of Illinois and Missouri have achieved a world-wide reputation for superior workmanship, ranking also as the largest on this continent. The competition and the capital invested is very large. These have been the means by which the rapid improvements in the plow have been brought about within the last twenty years. Any one attending our agricultural and mechanical fairs, will there find the cast-iron, the cast-steel, the cast cast-steel plows, hardened and polished to suit any soil; also constructed from the light one-horse plow up to a ten-horse steam plow; gang, trench and subsoil plows, some with low and high land sides, rolling land sides, rolling mold-board, with coulters and mold-boards of various shapes and forms, adjustable to suit the different soils and plowing. In fact, it is difficult to make a selection from so many—to know which is the best—*without a trial or test.*

Having given a slight sketch of the importance and improvements of the plow, we next come to our own important work of plowing; and it is to be supposed that an implement which is so much used by the farmer, he would certainly know how to handle and use it to the best advantage. But when we come to examine closely the work done, and judge the results of the same by the crops produced, we are convinced that too many farmers underrate good plowing as being essential in growing good crops.

And here the question may be asked: What is good plowing? I answer: To fit every inch of ground for plant food at a depth to which the roots of the different plants may descend in search of nourishment. This, you perceive, is using the plow to some purpose. Many farmers may yet be found who are skeptical whether good plows, with strong, well-trained teams attached, and a scienced plowman to guide them, can do that much? To these I remark: You may not be able to do it, for you will not comply with the conditions—conditions that are as immutable as the laws of nature. It is a trite saying, but nevertheless a true one for the farmer: "There is a time for all things; there is a time to plow; there is a time to sow; there is a time to reap;" and last, but not least, he may lose much of his profits and labor if he misses the right time to market and sell his product.

But to resume—what are the conditions? To plow at the rigth time, when the ground is not too wet or too dry—in either condition the soil is not comminuted or pulverized, and requires much labor to fit it for a good seed bed; especially is this the case in plowing our stiff clay soils, or the low places and ravines of the prairie and bottom lands, which are very tenacious. Either would be much benefited by drainage, of which I will speak hereafter.

Next, in order to do good plowing, the ground should be laid off in suitable lands, observing closely how best to drain the surplus rains from ground that is low and flat; or endeavor to supply the same by a different mode of plowing and plows on the sandy and hilly ground. And here allow me to speak of some of the modes of plowing of thirty years ago—how long before that the same had been practised, I am not able to tell. Land being new and rich, crops seemed to grow as by magic, and but few farmers in Madison county then thought that a change must take place sooner or later from their, to say the least, unskillful mode of plowing. And for one, I attribute many failures and poor crops of late years mainly to the imperfect mode of plowing in former years, of which the land-marks are yet plainly visible on too many farms. I here cite you to the general practice of commencing to plow on the outside of the lands and finishing in the center. And I remember the time well when a farmer would plow a head-land on each side of his field to get back the ground formerly thrown into the fence corners; he was considered a good farmer, though the rest of the ground was plowed in the "old cut and cover" style. Furthermore, little attention was given which way the ground naturally drained best. If nature had formed a drain in the shape of ravines or branches, they were considered the proper commencement of their lands, and the first furrow in laying off a land would be sure to be turned into them; this was practised by many farmers, so that often their best land became in a manner worthless and a nuisance, in becoming too wet and growing nothing but weeds or brush. As the ground became older, its product grew less and poorer, and often it was considered worn-out, when it probably had never been stirred over a depth of four inches. The result was that low places were formed on the high and dry ground, and having no outlet, the water would remain there for days after the rain had ceased; on the other hand, high ground or ridges would be formed in the formerly low grounds or around the fence, which dammed up the surplus water thus closing the natural drainage. Both, then—imperfect plowing and poor drainage—have been the main cause of our crops being so poor as scarcely to be worth harvesting; and the complaint has gone forth of late years, that wheat cannot be grown without loss, by many farmers who formerly produced from twenty to thirty-five bushels per acre. Corn, also, has lost much in productiveness by this mode—for official reports give Illinois only twenty-six bushels average per acre. But these reverses and losses will, in the end, prove of incalculable benefit to the progressive farmers, for they have brought about a great change in plowing. The plowing matches inaugurated by our county agricultural societies, of late years, have been instrumental in bringing out the best of plows and plowmen; and a noticeable feature has been, that nearly all competing at these plowing matches left their old plows at home, and selected an improved one from our implement dealers before entering for the contest. Manufacturers, also, have been induced to come out for competition on these occasions—and a lively time they had of it at our last trial. Before leaving the subject, allow me to make a suggestion to the implement dealers in this country: It would be of much profit to them and stimulating to plowmen, as well as aiding the agricultural societies, to offer one or more of their best and lately improved plows for premiums at these plowing matches, thereby affording them an opportunity to select the best plow for their use.

And now, to resume the subject: In laying off the ground in most suitable lands, I have discarded all small lands of less than ten acres; having tested lands of from one to four rods in width, convinced me that I was impoverishing and injuring my ground by too much washing at the surface and in the dead furrows, often interfering with much of the farm machinery working smoothly. Then by reversing the lands, and commencing in the dead furrows and finishing on the former ridges, the same process of washing would commence in the newly formed dead furrows, and nearly all this washed soil wuold be deposited on the lower, rich grounds and ravines, covering up the small growing plants, thereby causing bare places on my best ground, in which the weeds would grow very luxuriantly and bear seeds more than a hundred-fold, or compel me to cut them down before their seed matured. These defects in the small land system convinced me that it was wrong; and studying the matter over for some time, I concluded to plow my rolling ground in large lands, commencing them in the center and finishing on the outside with an open furrow, which mode proved so very satisfactory that I was induced to plow my wettest ground the same way; and after *six years' trial* and other experiments in the way of plowing, I am convinced and can recommend this mode of plowing to all farmers whose ground is rolling or flat. But this mode of plowing may not correspond with the theories of farmers who plow such ground in small lands. To them I can only say, that ten or fifteen acres of land thus plowed a few times, will convince them better than all theories combined; for, as by the old style of plowing, the ground was heaped up on the outside of your lands and formed in ridges, it is now raised in the centre, and the outside becomes lower by the deepening of the outside furrow, which on very flat ground can be enlarged to form a ditch of any desirable depth, and the gradual sloping sides—when found large enough to discharge all surplus water, may be seeded with blue grass. The sod will prevent its washing too much. Furthermoer, I insist that this is the most expeditious and best mode of plowing all sod ground or deep plowing of any kind, for it admits of the man and team to turn on the hard unplowed ground. And allow me to state that I am an advocate ef deep plowing on all of our Madison county lands, except our very sandy soils and sub soils. But I have observed that some farmers who have tried deep plowing often failed by going too deep at once, bringing up too much new soil; that the crops produced were poorer than when their ground was plowed shallow. They did not know that this new soil brought to the surface had but little life or elements suited to plant-food in it; for when we put our plows down into it, it comes up like so much hard pan, being almost impervious to water. It therefore in time, causes our ground to become less productive. This hard ground is formed in all our soils beneath the depth of our usual continued plowings by the pressure of the plow in lifting the furrow slice and the tredding of the horses feet, and by the fine particles that are carried down from the top soil into the subsoil by the rain falls. This hard pan is formed sooner in some soils than others. Shallow plowing will facilitate its formation; while deep plowing and regular rotation of crops, and especially, the sowing of clover will break it up before it can damage the crops to a great extent.

But as I cannot advise for all the different localities and soils in our county the particular rotation which is best suited to the farmers of the bottoms, uplands or prairie, I hope that this will be discussed by those present at this convention, for it is of great importance in keeping our ground in a healthy and fertile condition. In regard to breaking up the hard pan by plowing, either with a subsoil or trench plow, allow me to give some advice to those who have not used either. The object of using them is to pulverize and plow our ground to a greater depth than we have been doing with a single plow, which not only deepens the seed-bed, but also gives better drainage; and fields that were formerly too wet, will, by this kind of plowing become comparatively dry. We, therefore, should first make some experiments on a small scale with a subsoil plow; that is, only lifting the second furrow a few inches, and leting it remain in the bottom of the first. Its operation is somewhat similar to the workings of a large mole. By this the air is at once admitted more freely into the subsoil, and where air has gone, the rain that falls will as readily penetrate also. This subsoil, which before was almost impervious to water, had been of but little benefit to the growing crops, for the reason that those fine rootlets, by which plants feed, and which reach out in every direction of the soil, could not penetrate in that direction. Often in a wet season these roots are entirely water-killed, and the plants will show this by changing their color from a rich green to a pale, sickly yellow. By the use of the subsoil plow, this subsoil is fitted for plant-food to an extra depth of from four to ten inches. In my early breaking up of this hard subsoil I used a trench plow, and brought the new soil to the surface; when done in the fall, leaving the soil exposed to rain, snow and frost during the winter, it would generally have a good effect upon succeeding crops, especially corn; and if lime or some strong manure could be spread upon it as soon as plowed, very poor ground would at once become as productive as new land. But in my future breaking of this hard pan, I shall use a subsoil plow first, and in a year or two after use the trench plow; the top and subsoils will then become better assimilated than by the former mode of plowing.

In the breaking up old blue-grass pastures or meadows of heavy sod, it is decidedly best to trench-plow, throwing the second furrow on the surface; but never plow to a greater depth than four to six inches, for such ground will always be found porous and in a condition to absorb greater rainfalls than that cultivated a number of years in wheat or corn. The object in trench-plowing sod is, that you get a finer seed-bed than if you plow but one furrow deep, depending upon the harrow to reduce the sod to a fine mould—and such ground should always be plowed from the centre to the outside of the lands, for it is labor thrown away to turn on the rough plowed ground. Of the merits of this plan you can judge best by a test comparing small lands alongside of a field of ten acres in one land.

And here let me say that, when your outside furrows or ditches are of sufficient depth to carry off the surplus water, you can on every occasion, when such ground is to be plowed twice before planting or seeding, commence on the outside of your lands, or the old style, but the second should be reversed and commenced in the centre; this, also, is the best way in laying off lands of different sizes and shapes, when you cannot find their centre readily by stepping or measurement. And now allow me to give my opinion in regard to what kind of plows to use for common plowing, and for the different crops grown. For all crops that receive after-cultivation, such as corn, potatoes, sorghum, broom corn, which are generally termed spring crops, a plow with a short, upright mold-board is best. The ground plowed should show every furrow distinctly, nor should a furrow be less in depth than two-thirds of its width; and as you increase the depth the little ridges formed by each furrow will be proportionately enlarged, thereby exposing more surface, upon which the air, sun and rain act with great effect. The ridges are easier reduced by the harrow, and the ground remains more porous.

For fall wheat, barley or grass, a plow with a larger mold-board is best, to lay the surface as smooth as possible; the harrow will then not only pulverize, but also compact the ground, which is of much importance for the fall crops. The drill will work better and at a more uniform depth. But whatever kind of plows a plowman may use, he should always strive to cut a straight furrow of uniform depth and width wherever the ground or the shape of the lands admit of it, by which every inch of ground is best pulverized. But it being rather difficult to make all the different points in plowing plain in an essay like this, I can make better explanations on the black-board if desired by the convention, and here leave the subject of plowing in order to make a few remarks on drainage.

The question first comes up: Do we need drainage? The answer of which is brought home to every farmer in Madison county, with greater or less conviction, as his crops have suffered either by too much wet in the growing seasons, which prevented him from working his ground at the proper time for his crops or from drought. From observation and experience, I consider our small land system of plowing detrimental to good drainage, for the reason that we burden our low and wet grounds with an extra amount of water—when the rainfall upon them is already more than they need; ground that is naturally dry, and would, by a different mode of plowing, absorb and retain the rain that falls upon it for its own benefit, is deprived of the same by the facilities of many dead furrows which carry off the water. Many times we are favored with a good hard shower, which would moisten the parched ground to a considerable depth, but being plowed in small lands, the water soon finds its way to the dead furrows, at the same time washing away the needful soil from the growing plants.

A much better drainage could be effected, if surface drainage is intended, to plow large lands and cut your open drains with the plow wherever needed, by which mechod the aboved named evils are avoided, and your ground receives and stores a larger portion of the rainfall. But if the soil is such, or the ground too rolling, that these drain furrows wash deeper than is needful, it can be prevented by seeding heavy with timothy, redtop, or—best of all—blue-grass, a strip of ground eight feet wide the entire length of the main drains—this seeding should be done in the fall when sowing wheat or meadow. When this sod is a year old, you may cut your furrows deeper and wider by using the spade, and load upon your wagon this rich accumulated soil and haul it on to some of the poorer spots in your meadow, or on to your washed knolls and former dead furrows from where it had been washed. Then if you have a good sod plow, set it to run two or two and one-half inches deep, and plow one or two furrows on each side of your ditch as close as the near horse can walk to it, by which the sod is thrown from the ditch with a right-hand plow, and the sod left unplowed will protect its edge; the plowed portion is then used in sodding the ditch on its sides and bottom. If the plow is not convenient, the spade can be used. Such drains will last for many years—not interfering with your plowing, being firm to their very edges; the teams can step over them and the plowman follow by throwing his plow out and in when crossing. Such drains are much better than none at all—for, while they are kept open, the best of crops will grow on the drained ground, which otherwise would be unproductive. And as our land is comparatively new, we can aid this drainage by subsoil plowing, which facilitates absorption. The rains absorbed by the ground add fertility to the soil, by dissolving salts, lime and other elements which the soil may contain, and which, without the action of rain would remain dead and of no use to the plants. On the other hand, such stored rains will again afford moisture in a severe drouth by evaporation or capillary attraction to the growing crops, and these will not be affected or cut short as those which are grown on shallow plowed lands.

Our seasons are not as uniform as formerly. Showers sometimes few and far between; then again, showers all the time. Thus, if we store not when there is plenty, we will want when there is none. And as a deep vessel will hold more water than a shallow one before it overflows, so will deep plowed ground than that which is shallow. And now, if ground plowed in small lands or large lands, plowed shallow or to its utmost depth, and with open ditches, fail to drain any ground and restore it to its former fertility on account of its being too wet—(I presume it will be some time yet before one-half of us farmers will undertake the above labor to drain our ground)—then we have to underdrain our lands; and though it may also drain our purses of greenbacks they will be replenished with gold. In proof of this assertion, I cite you to Holland, England and to some extent in this country, though but a mere commencement has been made in Madison county by a few progressive farmers. While millions of dollars have been expended in Europe, and the work of underdraining is extended yearly, by miles of tile being laid, we have been slow to profit by their example.

Only think of laying tiles at a depth of from two to six feet underground to drain the surplus water from the surface, at an expense of $20 to $100 per acre as in England; yet all this labor and money has been paid back, with interest, by the ground so drained. For the statistics prove that, in wheat alone, the average yield of their former undrained ground was only twelve bushels per acre; while at the present, being drained, its average per acre is twenty-six bushels—quite an increase you will admit, to say nothing of their fine meadows that yearly yield from two to four crops of hay. And to refer you to Holland, with its stupendous works for draining, by which millions of acres have been added to their tillable lands that formerly were lakes, or submerged by the ocean waves. Thousands of wind-mills are kept almost in constant motion to pump the water out of the canals and ditches, to prevent their overflowing or inundation of large districts of low lands, and watchmen are stationed upon the dams, which were built to resist the constant and powerful breakers of the ocean, and no sentinel upon the ramparts of a besieged city watches the enemy with greater diligence than does the Hollander the raging sea.

In this country the venerable pioneer in underdraining, Mr. John Johnston, of New York, has demonstrated by dollars and cents that it pays—for he says that the tile draining pays for itself in two seasons—sometimes in one; an instance of which he had on his own farm. He has now rented his tile-drained land at a yearly rental of $25 per acre. I have referred to these works of drainage to prove that it certainly must pay, and we may be encouraged to try and reclaim some of our best lands—which are now in a manner worthless—by a few underdrains. I endeavored to get some information of the drainage commenced in our own county, but failed, Messrs. Kennedy and Cartwright being absent from home when I called to see them. And here I leave these important subjects with you, to criticise, improve or impart other useful information for our mutual benefit, that we may be enabled to reduce to practice what now seems impracticable, thereby improving the natural fertilities and productions of our farms until the wilderness shall blossom as the rose. And let me gently hint that if, with the great inventions and improvements of farm implements; improvements in our stock, and the diffusion of experimental and scientific knowledge, in the dissemination of which we are aided by our agricultural press, which is sown broadcast over this great country, we do not show a better record in the productions of our farms for the next ten years than in ten years past—I say we do less in advancing our own interests than those who have lived a generation before us, denied as they were of most of the advantages enumerated above, and we are not worthy the name of progressive farmers.

EDWARDSVILLE, January 28, A. D. 1871.

REPORT OF THE ANNUAL TOBACCO FAIR.

We furnish for the information of the public the award of premiums and sales of premium tobacco at the annual fair held June 15th, in the warehouse of Christian Pepper, on Market street, between 11th and 12th street, in St. Louis.

THE AWARDS.

First Class.—For the best hogshead manufacturing leaf, not less than 400 pounds net, Brown & Baker, raised in Franklin county, Mo., by W. H. Barrett, $200.

For the second best hogshead manufacturing leaf, not less than 400 pounds net, J. W. Booth & Son, raised in Bullard Co., Ky., $100.

For the third best hogshead manufacturing leaf, not less than 400 pounds net, Whittaker, Verdin & Gray, raised by J. M. Davis, in Osage county, Mo., $50.

For the fourth best hogshead manufacturing leaf, not less than 400 pounds net, J. M. Davis, raised in Osage county, Mo., $25.

Second Class.—For the best hogshead shipping leaf, not less than 1,200 pounds net, Lewis, Nanson & Co., P. E. Chappell, Callaway, $100.

For the second best hogshead shipping leaf, not less than 1,200 pounds net, C. & R. Dormitzer, C. W. Carter, Franklin, Illinois, $50.

For the third best hogshead shipping leaf, not less than 1,200 pounds net, J. W. Booth & Son, Edward Poindexter, Callaway, $25.

Third Class.—For the best hogshead cutting leaf, not less than 800 pounds net, J. W. Booth & Son, E. R. W. Thomas, Covington, Ky., $100.

For the second best hogshead cutting leaf, not less than 800 pounds net, J. W. Booth & Son, Worthington & Powell, Cincinnati, $50.

For the third best hogshead cutting leaf, not less than 800 pounds net, Thomas Rhodus & Co., $25.

For the best three hogsheads cutting leaf, offered by any one party, J. W. Booth & Son, 3 hogsheads, E. R. W. Thomas, Covington, Ky., $75.

Fourth Class.—For the best hogshead black wrappers, not less than 950 pounds net, A. Meyer, St. Louis, $50.

For the second best hogshead black wrappers, not less than 950 pounds net, A. Meyer, St. Louis, $25.

Fifth Class.—For the best prized hogshead leaf, not less than 950 pounds net, J. W. Booth & Son, Boone Bros., Clarkville, Mo., $50.

For the second best hogshead leaf, not less than 950 pounds net, J. W. Booth & Son, Boone Bros., Clarksville, Mo., $25.

Sixth Class.—For the best five hogsheads shipping leaf, quality and handling considered, offered by any one party, C. & R. Dormitzer & Co., St. Louis, $100.

For the second best five hogsheads shipping leaf, quality and handling considered, offered by any one party, Craig Alexander, $50.

Seventh Class.—Sweepstakes—For the best hogsheads manufacturing leaf, to weigh not less than 300 pounds net (open to general competition), J. W. Booth & Son, entered by J. G. Tatum, of Wentzville, Mo., $100.

Eighth Class.—For the best hogshead tobacco produced by the following States, not receiving a premium in any other class:

Virginia—No hogshead worthy, $50.

Tennessee—Shyrock & Rowland, $50.

Indiana—No entry, $50.

Missouri—J. W. Booth & Son, raised by W. E. Pollard, Lincoln county, $50.

Kentucky—Shyrock & Rowland, $50.

Ohio—No entry, $50.

Illinois—J. W. Booth & Son, raised by James Shyrock, Pike county, $50.

THE PREMIUM SALE.

The following shows the prices paid upon each lot offered:

First Class.—First premium, 4,386, Liggett & Dausman, St. Louis, $405; second premium, 4,432, Myers & Drummond, Alton, $301; third premium, 4,390, Liggett & Dausman, St. Louis, $140; fourth premium, 4,389, Liggett & Dausman, St. Louis, $101.

Second Class.—First premium, 4,310, E. Samuels & Son, St. Louis, $17; second premium, 4,329, P. Keller, shipper, $10 50; third premium, 4,323, J. A. Gregory, $11.

Third Class—Best Cutting Leaf.—First premium, 4,298, D. Catlin, St. Louis, $40; second premium, 4,300, D. Catlin, $40; fourth premium, 4,293, D. Catlin, $35; best hogshead, 4,294 and 4,297.

Fourth Class.—First premium, 4,280, J. G. Hayne, for scales, $15 25; second premium, 4,281, Hammer & Herman, $14 25.

Sixth Class.—First premium, 5 hogsheads best shipping leaf, 4,284, 4,306, 4,319, 4,328, 4,365, Wright & Craighton, Cincinnati, $11 75; second premium, second best, 5 hogsheads shipping leaf, 4,355, 4,356, 4,357, 4,368, 4,369, S. Peltz & Co., St. Louis, $11 75.

Seventh Class.—Sweepstakes.—4,405, A. Tinsley, Louisiana, Pike county, Mo., $2 52.

Eighth Class.—4,347, best hogshead from Kentucky, J. G. Haynes, St. Louis, $57; 4,349, best from Tennessee, E. Booth, St. Louis, $11 75, 4,359, best hogshead from Illinois, Pike county, White & Erickson, St. Louis, $63; 4,391, best hogshead from Missouri, Myers & Drummond, Alton, Illinois, $85.

NOTE.—Wherever but one name is given, it stands for the person offering the sample, the grower in that case having not been announced.

INFLUENCE OF FODDER UPON MILK PRODUCTION.

This question has often agitated the minds of reflecting farmers, and for the want of time and opportunity to perfect satisfactory experiments; has as often been set aside with the general conclusion; that rich feed would produce rich milk and plenty of it.

But few of the agricultural colleges of America have as yet furnished reliable data on this particular subject, hence, at the risk of being charged with simply compiling, but at the same time fully appreciating the value of this particular compilation, the Secretary inserts the results as made at the Agricultural Experiment Station in Moeckern, Saxony, for the detailed statement of which he is indebted to the *New York Tribune* and which were furnished to that journal by W. O. A., an ardent American student now attending or visiting the scientific agricultural schools of Germany.

It may not be amiss to state here in brief that this experiment confirms the generally admitted position by farmers in America, viz.: that toward the close of the season the quantity or yield of milk is less while the quality or richness in the elements of butter is much enhanced.

The question to be solved is this: *What effect does the quality—the composition—of the fodder, have upon the quality—the composition—of the milk.* If I have a dairy and make butter, it is worth while to know whether, by increasing the amount of fatty matter in the food, I can get a milk richer in butter, or whether, in case I wish to make cheese, during the hot Summer months, I can increase the amount of albumen and casein in the milk, by adding albuminous material to the food.

Here in Germany, when a question of this kind arises, they have a very simple way of settling it. They "try and see." And the spirit in which this trying and seeing, this experimenting is done, is the same spirit that has made Napoleon to-day a prisoner upon German soil, and borne King William, with his victorious army, to the gates of Paris; the spirit of System, of patient, systematic, thorough, intelligent work. How Dr. Kuhn and his assistants carried on this experiment, and what its plan and results were, we shall be better able to understand after a little reviewing of some of the fundamental principles of physiological chemistry.

The chemistry of the present day informs us that there are two general classes of substance which make up the great bulk of the organic matter of the plant, and of the animal body, or of its products, as milk. The main difference between them, as shown by chemical analysis, is that the one class contains nitrogen, while the other does not. Hence they are styled nitrogenous and non-nitrogenous substances. But the physiologist finds that they have very different uses in the animal system; that the non-nitrogenous or carbo-hydrates, as they are also styled, contribute more to the formation of fat, and make also fuel, whose combustion keeps up the animal heat—while the nitrogenous build up the muscles, the lean meat, and, at the same time, are believed to be especially efficient as a source of strength, in the same way that the carbo-hydrates generate heat by their consumption in the system. Let us, then, fix thoroughly in our minds the names and chief offices of these two classes of substances: 1. Nitrogenous, or albuminoids—flesh-forming, strength-giving. 2. Non-nitrogenous or carbo-hydrates—fat-forming, sources of animal heat, Meanwhile we will be content to know that in hay, in meal, in meat in milk, indeed in all that makes up the food and flesh of animals or men, these two classes of substances constitute the most important part, and that this distinction lies at the foundation of that application of science to cattle-feeding, which is called, on this side of the Atlantic "Rational Foddering."

Fat meat, the fatty portions of milk, and the butter, are non-nitrogenous, but lean meat and skim-milk cheese are nitrogenous. So the question to be decided by our experiment is, *Will a ration, rich in carbo-hydrates, give a milk rich in butter, or will a milk rich in albuminoids be produced from a food of corresponding composition?*

In the stables of the Moeckern Station are some stalls especially set apart for cows under experiment. During the course of the experiment these cows are fed and milked under the direct supervision of one of the chemists, Dr. Haase, whose duty it happens to be to attend to the feeding and milking. The cows are quietly eating their hay and oil cake, a cow-maid is milking one, and the Doctor is look to see that no milk is spilled, and is ready to take the milk and weigh it as soon as it is ready.

The general plan of the experiment is to feed the cows during one period of two or three weeks, with a ration rich in albuminoids, the ration being made up of hay, which we consider normal fodder, to which is added bean meal or rape cake, or some other substance rich in nitrogen; and then change the proportions, and for the next period furnish a preponderance of carbo-hydrates or hay, with oil, starch, &c. and note the difference, if any, in the quantity and quality of the milk.

That would seem to be quite a simple matter, but in fact it is very complicated work. To feed a cow three weeks on the highly nitrogenous food, and then suddenly change to a highly non-nitrogenous ration would be too great a shock upon the internal system to allow the experiment to be reliable. And further, natural change, that takes place in the composition and amount of the milk, independent of the fodder, makes the work still more complicated. To get over these difficulties we must start with a period of normal foddering on good meadow hay, then gradually change, through a transition period, to the more or less nitrogenous feed, as the case may be, and continue this latter course of feeding for a long while, so as to be sure that it has a fair opportunity to work out its full effect; then, in a second transition period, pass gradually to normal fodder; then on to the second special ration, which, on the supposition that the former was over-rich in nitrogen, will have an excess of carbo-hydrates, When this period has run on long enough there comes another transition period, during which the carbo-hydrates will be removed, until at length we come back to meadow hay again, and this normal foddering is kept up through the last period.

The actual rations in the different periods of the experiment were:

Period I. Normal Fodder—Meadow Hay. Transition, in which a highly nutritious material—bean-meal—was added in increasing quantities.

Period II. Nitrogenous Ration. Meadow hay, with bean-meal or rape cake. Transition during which bean-meal was replaced by carbo-hydrates, oil, or starch.

Period III. Non-nitrogenous ration. Meadow hay, with oil or starch. Transition, during which the carbo-hydrates were withdrawn.

Period IV. Normal fodder. Meadow hay.

"The amounts and compositions of the different rations are estimated by accurate weighings and analysis. The yield of milk during the normal periods at the beginning and end of the experiment give us a means of estimating the line of changes through which the quantity and quality of the milk would run, the natural variation in amount and composition during the whole time of the experiment—some three months and a half—and the variations from this line during the periods of special foddering, give us the influence of the foddering upon the milk, the results aimed at in the experiment."

"And what seems to be the probable result of these experiments? Thus far, it appears that no change in the quality of the food is capable of materially affecting the quality of the milk, at least so long as the ration is of such quality as to be healthy and is given in sufficient quantity."

Meanwhile one of the cowmaids has finished milking, and brings the pail to the doctor. He weighs it carefully on a scale standing close by and notes the weight. "You will notice," he says, "that the cows are numbered one, two, three, four. For each one there is a separate set of measures for the fodder and a separate milk pail. This is No. 3. The exact weight of pail is known, and that subtracted from the whole weight of pail and milk together gives the weight of the milk."

"As you see, I have the milk weighed from cow three. A portion intended for analysis is poured into a dish marked three, the date is also noted, and it is taken into the laboratory with similar portions from one and two and analyzed. The composition of the food given is also known from analysis, the quantities fed are regularly and carefully weighed out, and detailed accounts of the food given and milk obtained are kept, so that when the experiment is finished we have all the data from which to draw our conclusions."

Omitting further details, we pass at once to the result. First, as to the natural changes that the milk undergoes during the milking period, that is to say, as the time from calving increases. The average amount of milk given was: First period, 18.1 lbs., with normal fodder, meadow hay; last period, 14.6 lbs., with normal fodder, meadow hay. Falling off in three months, 3.5 lbs. Otherwise than in this falling off, about a pound per month in the yield, there was no especial change, save a very slight increase in the richness of the milk. Indeed it appears from these and other investigations, that there is generally a very slight change in the composition of milk during the milking period—that it becomes somewhat richer, and that there is a slight increase in the relative amount of albuminoids, and decrease in that of fat and sugar. However, during the first three or four months, at least, this change is too trifling to be of any practical consequence.

Now, as to the main result of the experiment, the influence of the nitrogenous and the non-nitrogenous rations.

The changes in the composition of the milk during the middle periods were so extremely small as to be of no real importance. In fact, the variation observed from day to day, and the differences in the milk of the different cows were greater than those found in the milk given in the different periods. To show how extremely small these differences were, and at the same time to give an illustration of the chemical composition of milk, I append the following figures, the first column showing the average composition, with the normal fodder of meadow hay, and the second with the addition of bran, meal or rape cakes to the hay, the third with hay and oil or starch. In 1,000 parts, obtained from these articles, were contained:

	Normal Ration.	Nitrogenous Ration.	Non-nitrogenous Ration.
Water	878	880	882
Butter	41	40	39
Milk sugar	44	44	43
Albuminoids	28	29	29
Mineral matters	7	7	7

In short, the differences are so minute as to be of no practical account whatever, and it appears that the variations in the quality of the ration were without effect upon the composition of the milk.

Now let us make sure that we understand this thoroughly. We have been talking of "quality" and "composition" of milk and fodder. By this we mean the relative amounts of the different ingredients of the milk, water, sugar, fat, albumen, casein, etc. The more organic substance, sugar, fat, and albuminoids in the milk, the richer; the more water, the poorer it is. When we say that the milk grows gradually richer with the increase of time from calving, we mean that there is more organic substance and less water in a quart, when the cow has been milked six months than when she has been milked only one month. The quantity, the *whole* "*mess*" yielded each day will be larger at the end of one month than at the end of six months, and on that account the amount of the organic substance in the *whole* "*mess*" will be greater in the former case, while the amount in *one quart* will be greater in the latter. And when we say that variations in the quantity of the fodder are without effect upon the quality of the milk, we mean that the relative amounts of fat, sugar and albuminoids in the organic substance of the milk is unaltered thereby. Suppose now I feed a ration, say 25 pounds of second quality hay, from which my cows yield an average of 20 pounds of milk a day, containing 2½ pounds of organic matter, of which 40 per cent. or 1 pound is butter. I increase this ration, or make it richer by the addition of turnips, oil-cake, etc., and obtain a yield of 24 pounds of milk, or one-fifth more. I have then a corresponding increase of one-fifth in the organic matter and the butter, and 3 pounds of the former and 1 1-5 of the latter.

There is just one more point to be explained. The experiments show that the composition of the organic substance remains unaltered by changes in the fodder; but how is it with the relation of water and organic substances—the richness in the milk? Will not green fodder, or pasture-feeding, give a more watery milk, and consequently a larger yield? I am not aware that this especial subject has been tested with sufficient thoroughness to decide the question. It has long been the opinion of practical men that a dry fodder would make a richer milk than green fodder. The later German experiments seem rather to oppose this idea, or at least to show that their effect is much less important than has generally been believed.

But so much is certain: When I have once found a ration upon which my cows will thrive, each one of them will give a certain amount of milk, the organic matter of which will have a certain composition. By varying the ration I can vary the total yield of milk and of organic substance—that is to say, of butter and cheese produced, and may possibly bring about a slight change in the relative amounts of organic substance and water; but the amount of organic substance in a quart of milk will vary but slightly, if at all, and the quality and the amount of butter in an ounce of organic substance will be practically unaltered.

Had but one experiment of this sort been made, the use of its conclusions for establishing rules for practice would be open to objection. But the better scientists of the present day have learned the fallacy of building conclusions on such narrow foundations, and taking warning of the fall of earlier and poorly supported theories, and loth to proclaim a theory to the world until it has a reasonable basis of experiment.

Dr. Kühn has carried out quite a number of investigations similar to the one above described, and several other well-known investigators have been for some time past at work upon the same subject. One of these latter, Professor Wolff, Director of the Experiment Station at Hohenheim, in Würtemburg, gives the result of a long series of investigations in the following language:

"One interesting result of these experiments is that the quality of the milk—the amount of butter it contains—leaving the taste out of account, has always remained the same, in spite of manifold and important changes in the quality of the fodder. In fact, the changes in the amount of butter in the milk, as determined by chemical analysis, are so unimportant as to be entirely unworthy of consideration.

"As the practical result of this, we are left to infer that the quality of the food exercises no influence upon the quality—the contents of butter in the milk, while, on the other hand, the effect of fodder becomes readily and distinctly manifest in the quantity of the milk yielded, and in the increase or decrease of the live weight of the animals.

"The quality of the milk seems, therefore, to be determined by the peculiarities of the breed or the individual animal, at least as long as the fodder is healthy, palatable, and sufficient in quantity."

Dr. Kühn gives the result of his own experiments, in so far as they are directly applicable to practice, in similar language:

"The influence of variations in the fodder in these experiments was manifested in the amount of milk yielded alone, and not in the quality. The influence upon the quantity is, however, quite appaparent as regards the desire of the farmer to increase the production of a certain element of the milk, as for instance, butter, by a change in the quality of the fodder, the above law is fully valid. The farmer must, on the other hand, look to the peculiarities of different breeds of cattle for that quality of milk which is best adapted to his own special purpose. If he will increase the quantity of milk yielded, he must select such individuals as give a good yield."

Foddering, then, if rightly managed, may increase the quantity of the milk, but will not alter its quality. Must, then, the milkman who sells his milk in the city, and the country dairyman, who makes butter and cheese, be content with the same quality of milk? or is there some other means by which each may obtain a milk adapted to his special purposes? Dr. Kühn suggests the answer to this question at the close of the paragraph just quoted. The subject is an important one; let us pursue it a little further.

Every man who will realize the largest profits from his cows must see to it, *first*, *that he has good milkers; second*, *that he feeds them well.* If he desires a large yield of butter, he must select breeds and individuals whose milk is rich in butter. If he sells his milk in the town, and does not care so much for the quality as long as the quantity is large, he will do best with other breeds and other individuals. At least so say the best German authorities, and they have experimented enough upon the subject to entitle their opinions to confidence.

What is believed here in Germany concerning the best method of foddering, and how science and practice have contributed to the grounding of German theories on "national foddering," will perhaps form the subject of another article. It will be more appropriate here to notice something of what statistics, experiments and practical experience say as to the milk and butter-producing qualities of different breeds.

In Saxony and Prussia, where a great deal of attention has been given to this matter, the Hollander, Holsteiner and Oldenburger breeds, from the lowlands of Northwestern Europe, the Allgauer, from the mountainous regions of Southern Bavaria, and the English breeds—the Ayrshire, Suffolk, Cheshire, Yorkshires, &c.—are the most popular as milkers; while the Shorthorns, Durhams, &c., are preferred for fattening.

The statistics of a large number of farms in the kingdom of Saxony, for the year 1853, show that the average yield per cow in the year 1853 was:

	Quarts milk.	P'ds. butter.	P'ds butter in 100 lb. of milk.
Allgauer................	2,664	269	10.1
Hollander...............	2,859	252	8.8
Native Saxon cattle.....	2,110	190	8.5

Whence it appears that the Hollanders are the largest milkers but that the Allgauers give a milk much richer in butter; 100 pounds of milk from the former making 10.1 pounds of butter, of the latter only 8.8 pounds. A very natural conclusion from this would be for the butter-maker to select Allgauers, and the milkman who sells his milk in town, to fill his stables with Hollanders. And indeed, among the milkmen in this region, Hollanders are the most popular breed.

As to the quality of the English races as butter-producers there seems to be a lack of accurate statistics. The best sources represent the average butter production in England at 180 to 200 pounds per cow, yearly; and in the Lowlands across the Channel—Holland and Holstein—at considerable less, or some 112 pounds, which would make the English cows better butter-producers than the Hollanders. Von Weckerlein, a noted German cattle breeder, who has made this subject a matter of a great deal of observation and experiment, puts the English breeds, the Yorkshire and the Suffolk a little below, and the Devons and Herefords somewhat above the Allgauers, but finds them all superior to the Hollanders in richness of milk. The Shorthorns have likewise the reputation of giving better quality but smaller quantity of milk than the Hollanders.

In general, in Germany, where English, French and German breeds of cattle have been tried quite thoroughly, the Shorthorns are, as far as my observation goes, looked upon as most excellent for fatting; the Allgauers, Devons, and Herefords are much liked for butter and cheese-making, while the Hollanders are special favorites among milkmen.

It seems to me that these two breeds, the Allgauers and Hollanders, deserve rather more attention among our cattle-raisers in America than they have as yet received. We are quite well acquainted with English breeds, but the German are almost unknown to us. And yet, the most intelligent German farmers who can import Devons and Durhams, as well as Hollanders and Allgauers, and who have tried all these races faithfully, give decided preference to to the Allgauers and Hollanders as milkers, and consider the Shorthorns superior only in fattening qualities.

The Allgauers are small or medium sized, fine-boned, thick-set, and very finely built. The large amount of milk yielded by this breed, its richness, and at the same time their small consumption of food, make them most desirable cows for the dairy. Some herds average between 2,500 and 2,600 quarts per head yearly. For regions where fodder is uncertain and not over-good in quality, the Allgauers can be very highly recommended. The Hollanders, on the other hand, are large and stout built—the cows often weigh 1,650 or even 1,700 ℔, are remarkable for their very large milk production, amounting in some cases to nearly 4,500 quarts per year, though not very rich in butter. They require, however, rather high feeding, but on the other hand, are very easily fattened. On these accounts the Hollanders are especially adapted to the neighborhoods of large towns. where brewery and distillery refuse* and commercial food, as oil cakes, are cheap, and the fresh milk finds ready sale.

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* In St. Louis milk produced from such feed is very much—and justly—in disrepute.

FIELD TRIAL OF REAPERS, MOWERS AND OTHER HARVESTING MACHINES, HELD JUNE 22, 1870.

The trial of harvest machinery under the direction of the State Board of Agriculture commenced on the 22d of June and continued three days. It was held on the farm of Dr. W. W. Henderson, in the beautiful valley of Florissant, St. Louis county, and was perhaps the most extensive as well as successful trial ever held west of the Mississippi. The circular put forth by the Board announced that there would be one award each, viz: the certificate of the Board—for reapers, mowers, combined reapers and mowers, self-rake reapers and harvesters. It further announced that the trial would be conducted, in the main, under the rules which governed the great reaper trial held at Dixon, Ill., in 1862. The committee were instructed to be guided principally by the following scale of points, viz: 100 making a perfect machine:

1.	Quality of work	40
2.	Simplicity of construction	10
3.	Durability	15
4.	Ease of draft	20
5.	Price	5
6.	Facility of management	10

Besides that, a few plain rules were submitted, charging operators and manufactures, when before the awarding committee, in no wise to compare their own machines, in point of fact or by name, with any other machine, present or absent, and not to refer to any former trial, victory or defeat in which their machines have been engaged. The awarding committees were each furnished with a memorandum book, and requested not to compare notes; to keep their own counsel and make a just decision in the award according to the best of their judgment. Hon. Henry T. Mudd, President of the Board, then appointed the following gentlemen the committee on reapers and harvesters: Messrs. W. T. Essex and Wm. Stark, members of the Board (the first to be chairman,) Thos. G. Settle, Willis Hord and Henry A. Brandes. In applying the dynamometer, Henry D. Emery, Esq., of the *Prairie Farmer*, by request, acted with the committee with special reference to keep the records while applying the draft test of the instrument:

The following machines were entered as—

REAPERS.

Kirby, entered by D. M. Osborn & Co., St. Louis, Mo.
New York Clipper, entered by Barnum Bros., St. Louis, Mo.
Marsh Harvester, entered by Marsh, Stewart & Co., Plano, Ill.
Burdick, entered by D. M. Osborn & Co., St. Louis, Mo.
Champion, entered by St. Louis Agricultural Machine Company.
Climax, entered by Stewart & Needham, St. Louis, Mo.

COMBINED REAPERS AND MOWERS.

Kirby, entered by D. M. Osborn & Co., St. Louis, Mo.
New York Clipper, entered by Barnum Bros., St. Louis, Mo.
Climax, entered by Stewart & Needham, St. Louis, Mo.
Acme, entered by Stewart & Needham, St. Louis, Mo.
John P. Manny, entered by John P. Manny & Co., Rockford, Ill.
Ætna, entered by E. M. Holidge, St. Louis, Mo.
McCormick's Advance, entered by P. Mohan, St. Louis, Mo.
Bucyrus, entered by Bucyrus Machine Company, Bucyrus, Ohio.
Champion, entered by St. Louis Agricultural Machine Company, St. Louis, Mo.

REAPERS AS DROPPERS.

New York Clipper, entered by Barnum Bros., St. Louis, Mo.
Climax, entered by Stewart & Needham, St. Louis, Mo.
Acme, entered by Stewart & Needham, St. Louis, Mo.
John P. Manny, entered by John P. Manny & Co., Rockford, Ill.
Ætna, entered by E. C. Holidge, St. Louis, Mo.
Bucyrus, entered by Bucyrus Machine Company, Bucyrus, Ohio.
Excelsior, entered by J. F. Seiberling & Co., Akron, Ohio.
Champion, entered by St. Louis Agricultural Machine Company, St. Louis, Mo.

SELF-RAKING REAPERS.

Kirby entered by D. M. Osborn & Co., St. Louis, Mo.
John P. Manny, entered by John P. Manny & Co., Rockford, Ill.
Ætna, entered by E. C. Holidge, St. Louis, Mo.
Marsh Harvester, entered by Marsh, Stewart & Co., Plano, Ill.
Burdick, entered by D. M. Osborn & Co., St. Louis, Mo.
Excelsior, entered by Seiberling Machine Company, Ohio; H. Kuhleman, agent, St. Louis, Mo.
McCormick's Advance, entered by P. Mohan, St. Louis, Mo.
Champion, entered by St. Louis Agricultural Machine Company, St. Louis, Mo.

HARVESTERS.

The Marsh, entered by Marsh, Stewart & Co., Plano, Ill.

MOWERS.

Kirby, entered by D. M. Osborn & Co., St. Louis, Mo.
New York Clipper, entered by Barnum Bros., St. Louis, Mo.
Climax, entered by Stewart & Needham, St. Louis, Mo.
John P. Manny, entered by John P. Manny & Co., Rockford, Ill.
Acme, entered by Stewart & Needham, St. Louis, Mo.
Ætna, entered by E. C. Holidge & Co., St. Louis, Mo.
Bucyrus, entered by Bucyrus Machine Company, Bucyrus, Ohio.
Champion, entered by St. Louis Agricultural Machine Company, St. Louis, Mo.
Meadow King, entered by Gregg, Plyer & Co., Trumansburg, Tompkins county, New York.

It will be seen at a glance that the best machines and latest improvements of the day were present, and in such numbers as to make strong competition. Most of the machines were operated by or under the direction of their respective inventors, who knew all their

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*It must be borne in mind that the machine designated as the "*Acme*" is in fact the improved "*Climax*," and is to be known as such. The machine denominated "*Burdick*" is the improved "*Kirby*."

strong points and could show them up to the very best advantage That these men also find out the weak points of their machines by these trials is not only possible but quite probable; and that they are promptly corrected is evident to any one who has observed the advance obtained in late years. Thus even defeat results in good to each competitor; but most of all, also to the farmers who purchase their machines.

THE TRIAL—GENERAL REMARKS.

In order to bring the work of each machine prominently before the committee, a fine field of wheat, yielding perhaps fifteen bushels per acre, was laid off into acre lots. There was one gavel cut around each lot, leaving just nine-tenths of an acre for the machines. For these, lots were drawn; but there was really very little difference in the quality or stand of grain, except that some lands had a little stronger ascent to be overcome. On only one land was there the least lodged grain, and that fell to the lot of the winning machine (*Clipper*), which, not being ready when called, was permitted to cut it last.

Every machine in this trial worked well, and left the grain in the most satisfactory condition, although some were operated as droppers and others as self-rakers; while the Marsh Harvester not only cut and raked, but also bound its grain, and became at once the favorite and the observed of all observers. Except the Marsh and its peculiar work, and no decision could have been made on this trial *on the quality* of the work *alone as a point.* But the committee used their notebooks, and in after trials, when these same machines again appeared in their respective classes and combinations, their memoranda were brought into use. After this the machines were put into heavier work and their operations more closely observed, but all behaved well; without the test of draft, without the price list, weight of machines, and above all without a scale of points, no just criterion or award would have been possible without repeated trials.

In the heavy grain the dynamometer was applied, and the draft of each machine determined. Formerly, in the early days of reapers, some were known as horse-killers. No one need buy such a machine at present, for he can know pretty nearly the draft of each machine by actual test. It is not to be denied, that every expedient is employed by the operators to make the machines draw light, but where accidently, or by the team not keeping close to the grain, the machine did not cut all it could, the tape-line was applied, and the average cut recorded.

After this test the combined reapers and mowers were *altered* from reapers to mowers in the presence of the committee, and the time noted. They were now to be operated as mowers. At this time also, an opportunity was given each operator or inventor to explain the merits of his machine. But four of the competing reapers had mown any when a shower came up, and it rained just as the men had adjourned for dinner. Some time was lost, and to put all the combined reapers on the same footing (the grass being wet), the mowers were put in—the balance of the combined machines laying by.

We must here state that the meadow selected, was thought by superficial observers to give little or no test, but the machinists did not clamor for heavy work after they got into it. There was a dead aftermath at the bottom, while a good deal of dead-ripe chess was mixed with the timothy and clover. There were also bramble and elder bushes; and altogether the test was a good one, and so considered by the operators. That all the machines did such good work, is only another evidence that no mediocre machines were on trial· There were some little mishaps known only to the operators, which need not occupy space in explanation, because they were without influence upon the decisions of the committee.

The draft test was here also applied to the mowers. It was found by actual test of the machines that had previously mown, (as combined machines) by the dynamometer, that the cutting was lighter after the rain than before, whereby some attempted to make a little capital. To conclude the whole matter and the trial, the *combined machines* accepted the morning test of their respective machines as mowers as sufficient; the others either followed or withdrew, and here the trial ended.

It would be the height of injustice not to commend the patience, industry and pluck of the committee. For three days they had almost literally broiled in the sun, and wearied their limbs in following the machines, but nothing daunted they entered the room, compared notes on each machine, added the figures, and at about 11 o'clock P. M. declared their labors ended, with the following result:

But before giving the result of the trial and the awards of the committees, we beg to call attention to the fact, that the inventors themselves, in becoming thoroughly acquainted with the respective merits of each machine, are very much stimulated to devise still greater improvements, and that therefore these trials are of incalculable value to them, and ultimately to the farmer. As has been well remarked by high authority: "A reaper and mower trial is no child's play." It costs labor, anxiety and money—none of these are by any means to be avoided. The trifling banter of agents ought never so to influence men as to rush into a trial without counting the cost. We believe all the State Agricultural Societies have now agreed to give no premium except upon *actually tried machines*; even respectable County Agricultural Societies pursue this course. It will be some time before Missouri will have a State Agricultural Society, (the why? it is not our purpose now to discuss) hence it was eminently proper that the State Board of Agriculture should take this matter in hand, It has been asserted by competent judges, as well as participants and contestants as far as they have given expression to their views, that that trial was well and fairly conducted. When agricultural journals assert that all that need be done at such a trial could be accomplished in a day, they are very much mistaken—(two weeks would be better than one); neither was it designed nor expected to hinder farmers more than a day, if that time was all that could be afforded to witness the trial. A large or small attendance made no difference, except as to its effect upon the operators or competitors. Still, it would have been a gratification to have had a crowd of interested (farmer) spectators. But to return to our subject.

AS HARVESTERS.

The *Marsh*, entered by Marsh, Stewart & Co., Plano, Illinois, stands as yet unrivalled; is declared to be a full step in advance of all others, with the following specifications: Weight of machine 870 lbs; draft, 270 lbs; price $185, at St. Louis, $195; width of cut 5 feet; time of cutting nine-tenths of an acre, 36 minutes, with one binder (an expert) who bound up all well. Certificate awarded.

The certificate for the best *Combined Reaper and Mower* was awarded to the *New York Clipper*, entered by Barnum Bro's, St. Louis, Mo. Weight of machine, 875 lbs; draft reaping 201 lbs; mowing 235 lbs; cut of machine 6 feet; actual cut at trial 5 feet 6 inches; time of cutting nine-tenths of an acre, 41 minutes. Grain heaviest of any, on first trial. Price—reaper, $156; mower No. 3, $135; combined machine No. 4, $190.

CLAIMS OF THE CLIPPER.

"No plan for harvesting grain has ever been devised so simple and reliable as that of the *Dropper*. No other machine wastes less grain, and none leaves it in so good condition for binding. The one objection made to it, that the grain must be bound as fast as cut, is less real than imaginary; for, taking into account the first cost, it can be shown, even when it is necessary, for want of help, to stop the machine each time round the field and remove the cut grain, that it is a very economical harvester.

We have spared neither care nor expense to so revise and improve the Dropper-Attachment to the *Clipper* for the harvest of 1871, that it will insure the best possible combination of a Dropper-Attachment with a Mowing-Machine.

The Finger-Bar on the Dropper is placed back opposite the centre of the driving-wheel. It is therefore unnecessary to change the position of the driver's seat to balance the machine, or to lengthen the pole in order that the reel may not strike the horses.

A separate Steel Finger-Bar is furnished for the Dropper, with malleable-iron guards faced with steel plates.

On the under side of this Finger-Bar is riveted a light steel truss-plate, making a very stiff and, at the same time, a very light bar.

The Grain-Wheel is large, and made with wrought-iron spokes, both very light and strong.

The height of cut can be regulated from three to eighteen inches, and the bar can be tilted down so as to pick up lodged or tangled grain.

The New Open Reel is both light, beautiful, and very strong.

The Treadle is directly in front of the seat; the driver can operate it with ease by either foot.

CLIPPER NO. 4, WITH SELF-RAKE.

It is well known that there have been numerous attempts, and nearly all of them failures, to combine in a single machine a first-class mower and a first-class reaper.

We have at length accomplished this, and have succeeded in attaching a Self-Rake to the *Clipper* which will maintain as good a reputation in the harvest field as the mower does in the meadow.

Our Self-Raking Reaper-Attachment was thoroughly tested through the past season under all circumstances, in tall rye, short oats, and in heavy ,wheat, both lodged and standing, on rocky and soft ground. These tests demonstrated that it was equal to the most trying circumstances, and was in all respects a first-class reaper.

Our No. 4, or large size Mower, is so made that either a Self-Rake or a Dropper-Attachment can be applied to it at any time, without change to the machine itself, or in any way compromising its qualities as a mower.

When used as a Reaper, the finger-bar is opposite the centre of the driving wheel. It is therefore not necessary to change the position of the seat, nor to lengthen the pole. By placing the bar in this position, the machine is perfectly balanced. There is not too much weight on the horses' necks, as is the case with front-cut reapers; nor too little, as in the back-cut reapers, which causes the pole to fly up between the horses' heads when backing the machine.

The Rake-Head is low down, compact, and very strong, without being heavy, and is so thoroughly protected that no loose straw will be caught around the moving parts. This and all the other working parts of the machine, can be conveniently seen by the driver without turning his attention from the team.

The Rake is easily controlled, and whether the grain is light or heavy, the bundles can be made uniform in size; or at the option of the driver, the grain can be laid in swath, without changing any part of the machine.

The finger-bar and platform can be easily tilted while the machine is in motion, so that the worst lodged grain can be gathered on the platform, and then raked off in bundles.

The height of cut ranges from three to eighteen inches, and can be easily and quickly regulated.

Under all circumstances, the machine will cut a full width-swath.

The Driving Wheels of the No. 4 *Clipper* being large, it makes a reaper admirably adapted to work on soft or rough ground.

The Draught is light, and the machine is easily handled by both the team and the driver.

The change from a mower to a reaper, or from a reaper to a mower, is made by removing and replacing two pins and two nuts. This easily be done in from five to ten minutes' time."

BEST SELF-RAKE REAPER.

For this class of machines, the *Burdick*, entered by D. M. Osborn & Co., St. Louis, Mo., received the award. Weight of machine 875 lbs; draft on actual cut, 226 lbs; width of cut, 4 feet 8 inches; time of cutting nine-tenths of an acre, 43 minutes. Price $160.

CLAIMS OF THE BURDICK AS A SELF-RAKER.

"It is so light of draft and so easy of management, that but one span of ordinary horses, and a boy to drive them, are all that are required to operate it, while its mechanism is so simple and easily understood that it can be readily kept in order.

The Self-Rake is the same in principle as the one used on the Kirby Combined Machine. It delivers the gavels at the side of the machine, entirely out of the way on the next round, and is constructed so as to make a gavel at every revolution, or as often as the driver chooses, being perfectly controlled by him. As in the Combined Machine, the Rake is sustained upon the frame of the Machine, and *not upon the finger-bar*, so that the cutting apparatus is always in the right line, and the gearing for driving the Rake always works smoothly.

The Driver's Seat is located outside of the main wheel, entirely out of the way of the gearing, with the levers for controlling the action of the Rake and throwing the Machine out of gear, within easy reach.

The machine is supported by but two wheels, (between which the frame and cutting apparatus are firmly suspended), one of which is a main wheel, driving the gearing: the other a grain wheel, supporting the outside end of the platform.

By means of a detached lever applied to the axle-plate of the machine and grain-wheel, the frame, cutting apparatus, and platform can easily be raised or lowered *perpendicularly,* and fastened at any desired height, from 2 to 18 inches, by means of a pin passing through the axle and circle-plate of the machine, and another through the socket and axle of the grain-wheel. Another lever is so connected with the frame and hinged tongue, that the machine can be easily and instantly tilted up and down by the driver while it is in motion, to pick up lodged grain or to pass an obstruction.

By the above arrangements it will be seen that the cutters can be set at any desired height, (according to the average height of the grain to be cut in any particular field), and can be tilted down (while the machine is in motion), so that the rake-heads will gather in any grain that is shorter than the average, or that has fallen down.

The Gearing is protected from dirt, and is so constructed that the machine is almost noiseless in its operation.

There is positively *no side draft*, and the machine is so perfectly balanced that there is *no pressure on the horses necks.*

It is made almost wholly of iron and steel, so arranged as to render the machine *very strong*, while the simplicity and construction of gearing avoids unnecessary friction, rendering it of *very light draft* and *extremely durable.*

It will work on side hills, or over rough ground, with the utmost facility.

A swath 5½ feet wide can be cut without driving usually close to the standing grain."

BEST REAPER.

This premium was open to all reapers, and they could come in in any form. The award was made to the *Climax*, entered by Stewart & Needham, St. Louis, Mo., which was used as a dropper. (See illustrations.) The weight of this machine is 800 lbs; the draft 203 lbs; cut 6 feet; actual cut on trial 5 feet 2 inches. Price $150; combined reaper and mower, $185; single mower, $130.

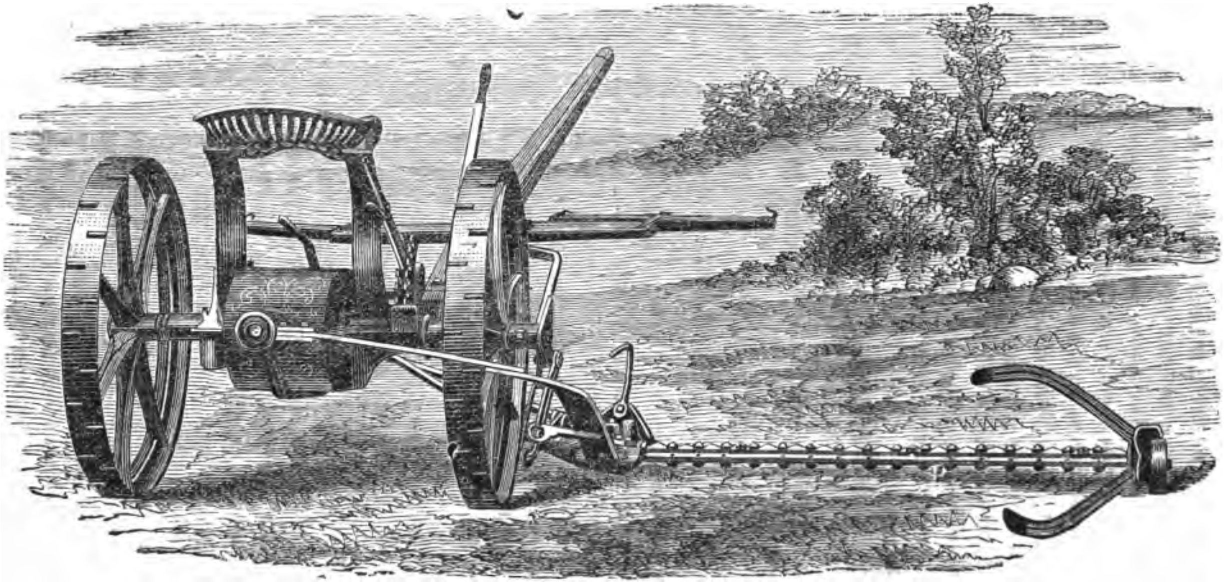
The *Climax* also received the award as the best reaper used as a dropper.

CLAIMS OF THE CLIMAX.

"*Gearing.*—The cogwheels and other gearing of the *Climax* occupy the smallest possible space, and are all *inclosed in a neat iron case*; this protects the works, prevents rust, excludes dirt, grass and everything that would clog or injure the gearing. The main shafts are made of *steel*, and are uniform in size, and every part of the machine is constructed of the *very best material.* The gearing is very strong and compact in construction, smooth in motion and communicates its power to the knife with but little friction, and therefore makes the draft of the machine very easy.

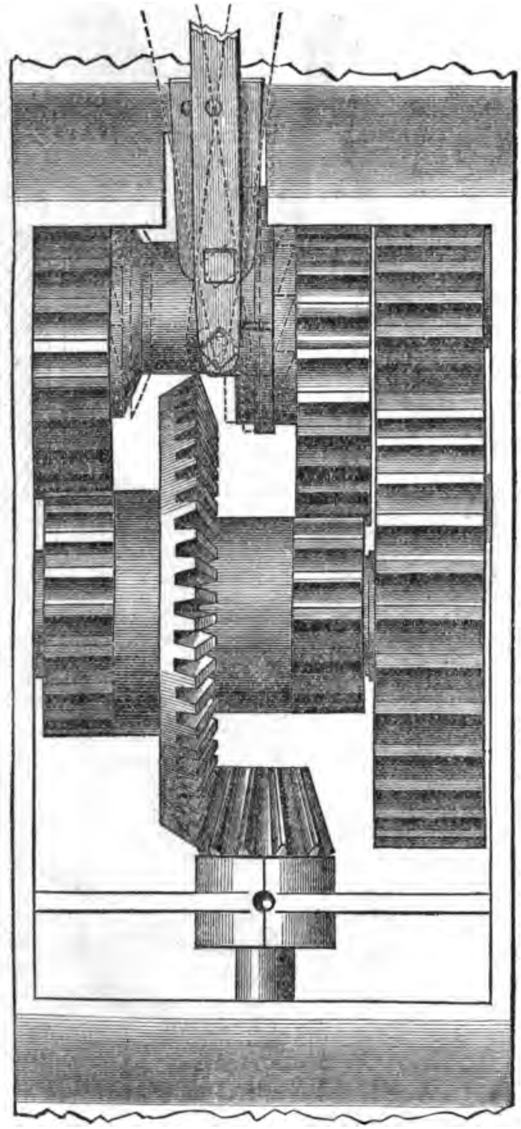
Floating Bar.—The *cutter bar and frame* are made of *spring steel*, this gives prompt adjustment to the surface irregularities of the ground, a peculiarity which the farmer will appreciate.

Guards.—The guards are made of malleable iron, polished and faced with steel, giving the knife a shear cut.



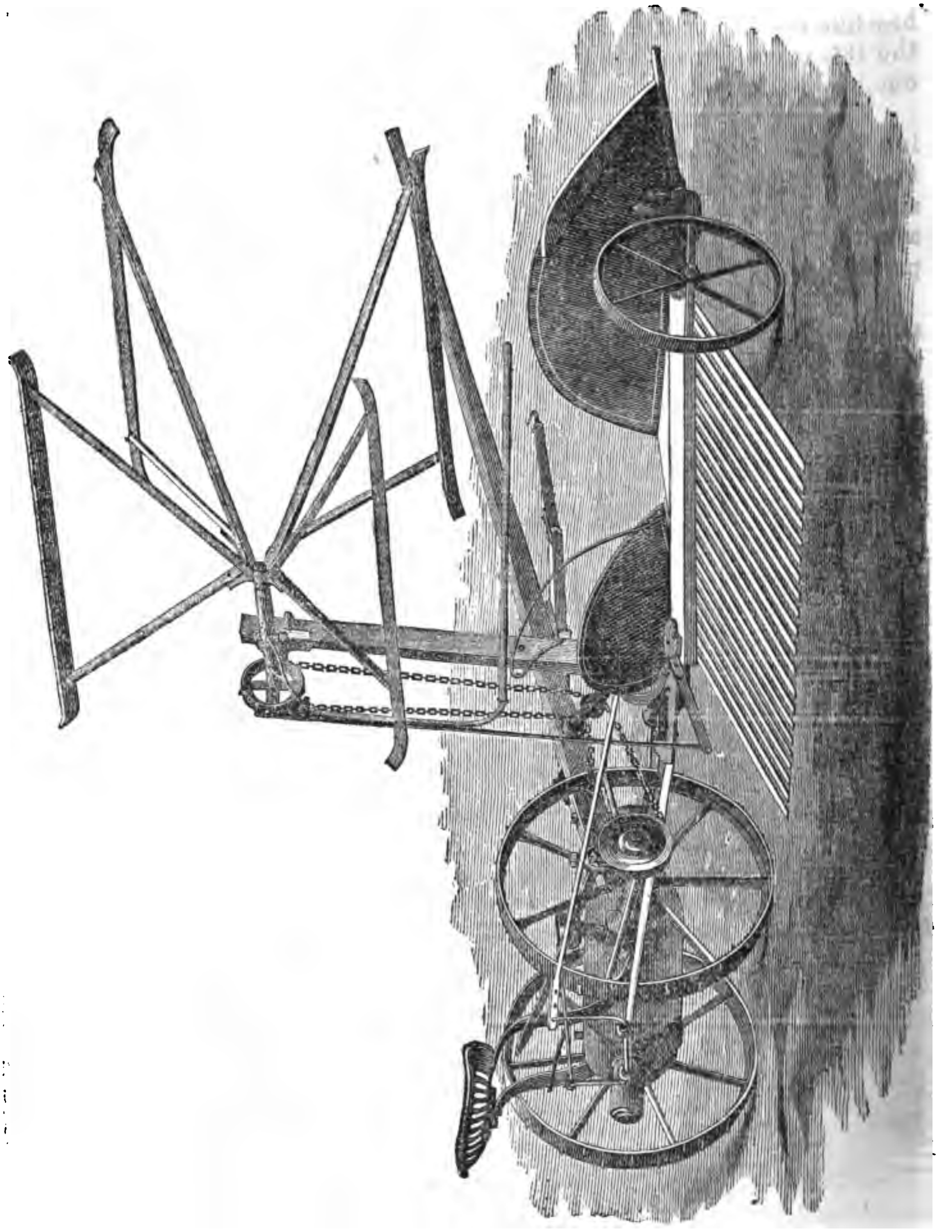
CLIMAX, Senior—4½ feet cut.

Sickle Backs.—However perfect a mower or reaper may be in other respects, if the sickle is not constructed on scientific principles the whole apparatus must prove a failure. Long experience has demonstrated that hard iron or steel subjected to constant jarring or vibratory motion loses its fibrous character and becomes granulated or like cast iron. This indisputable fact induced the manufacturers of this machies to use soft tenacious iron in the construction of the sickle back, and the wisdom of their choice must be apparent to all.



CHANGEABLE SPEED GEARING.

Changeable Speed.—One of the principal advantages claimed for



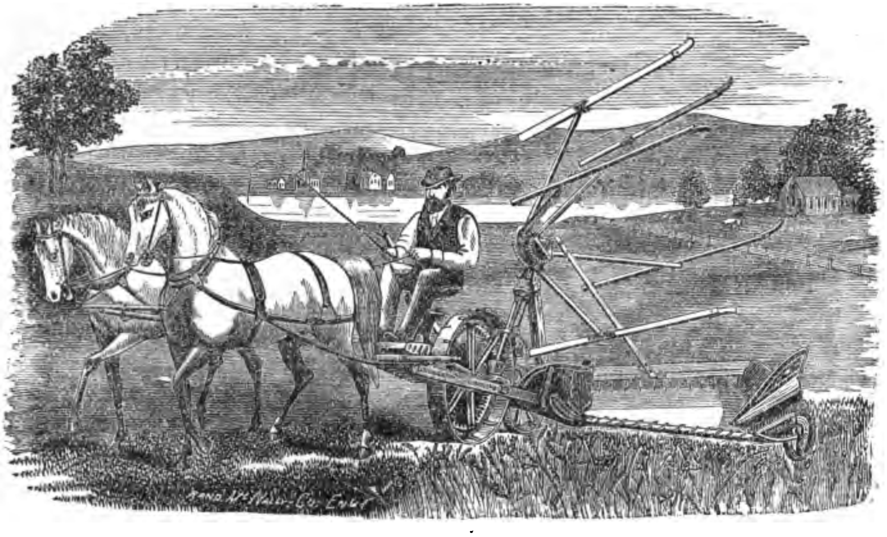
THE CLIMAX WITH DROPPER.

his machines, and we think justly so, is *changeable speed* by which, the driver can *without leaving his seat or stopping the team, increase or diminish* the motion of the sickle, just as the cutting may require. This is done by a single lever shifting a double clutch coupling on a horizontal shaft, from one spur gear wheel to another, of unequal size, the larger one propelling a small pinion, and the smaller, a larger one, each in turn communicating the *fast* or *slow* motion to the sickle.

The Climax With Dropper.—The Climax is well adapted to working as a Dropper. It will cut any desired height from 3 to 18 inches and both ends of the *cutter-bar* are operated simultaneously by a single lever with great ease while the machine is in motion, thus avoiding delays usually experienced in adjusting the cutter-bar to the particular kind of grain to be cut.

For the best Mower, the award was made to the *Acme*—by the same inventor as the *Climax*. This is a comparatively new machine. but it made some extraordinary performances, such as running the horses around the mowing lot, cutting down or running at fence stakes, etc. This little thing made a host of friends. Draft 204 lbs.; cut 4 feet 8 inches. Price, $125.

In noticing the winning machines, our duty is performed only in part, for we feel that *all* the machines entered at this trial are well entitled to special consideration, because all are of a high order of merit, no mediocre machines participated in this trial, and the Board regrets exceedingly not to have it in their power by actual awards to show their appreciation.



THE JOHN P. MANNY,

entered by the inventor and his company of Rockford, Illinois, (see illustration), ranked next to the self-raker that took the prize. Judging from the quality of work and all the points noted, its weight and heavy draft lost it the award. The machine weighs 950 pounds; is very durable, having none but the best material used in its construction. The new rake works beautifully, without any jerking, and rakes off the bundles in the very best manner. The rake halts an instant just as it delivers the bundle, and thus avoids the flirting which formerly threw part of the buts a little from the rectangular line. Its draft was 260 pounds, and the team which drew it came out in good condition. Its quota was cut in 38 minutes.

Had Mr. Manny gone into the time contest as a hand-raker. and as he had some notion of doing, himself driving and raking with two binders to follow, we believe he would have given the Marsh (it being calculated for two binders) a very close contest. This machine cut five feet clear, and cost $175. It certainly ranks among the best machines in use. It was altered into a mower before the committee in just *three minutes*, and we have no doubt would have done mowing equal to any. It was not tried, because, being a left-handed machine and the grass being wet, would have necessitated a clearing of its track.

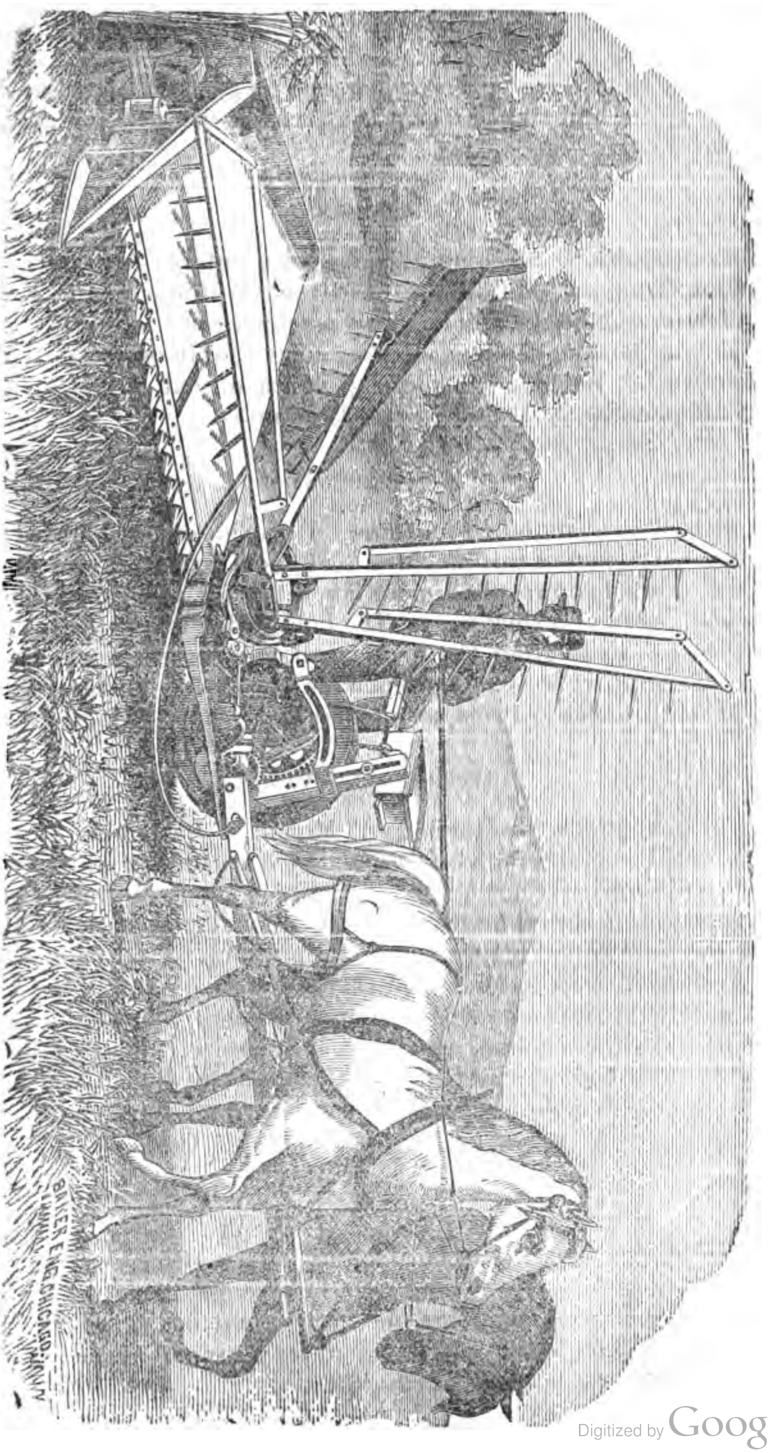
THE ÆTNA,

entered by E. C. Holidge, St. Louis, Missouri, ranks next to the Manny, on the average points, as a self-raker. It was evidently true (as he said) that the operator had not often been in a contest like the present one; yet, notwithstanding the machine was twice stopped to tinker just a little, it performed its task in 35 minutes. This machine weighs 900 pounds, and costs $142—certainly a low price for so good a machine. Draft, as reaper, 327 pounds; width of cut five feet. It is a fact that some of the machines were a little *unfortunate*, (there is no other word that we can here use) and this was one of them. A little more thorough preparation on the part of the operator, the Ætna would have made a better exhibit, because it is a well constructed and durable machine.

THE KIRBY,

entered by D. M. Osborn & Co., St. Louis, Missouri. (See illustration.) Its average on work is as high as the best; its weight 900 pounds; price, as a combined self-raker, $185. Its draft was lighter than that of any other combined self-rake machine. It was drawn by the smallest team used during the trial, an exceedingly diminutive pair of mules, which seemed to handle it with ease, and came out in good condition.

The Kirby has the same self-rake and cutting apparatus as the "Burdick Independent Reaper" manufactured by the same firm, which took the first premium as a self-raking reaper. So it will be seen that the victory of the Burdick applies in a marked degree to



THE KIRBY AS A SELF-RAKER.

the Kirby. The Kirby has been long and favorably known as one of the leading combined machines in use, and its large and constantly increasing sale attests its worth and acceptability. It does its work well, both in mowing and reaping, and is good for hard work and plenty of it, enjoying among the farmers using them an almost wonderful reputation for durability.

BUCYRUS.

As a combined machine, the *Bucyrus*, entered by the Bucyrus Machine Company, of Bucyrus, Ohio, ranked third, having received the high average of 94 points. This machine came late into the field, and the preparations to work it were somewhat imperfect. It did excellent work. Weight, 750 pounds; width of cut, 5 feet 6 inches; draft 256 pounds; cost, $145; time, 35 minutes.

CHAMPION

Did its best as a combined machine. It can hardly be doubted that if the team attached to this machine had been large, or even medium the test would have resulted more favorably for the contestants. It cuts well, even at a slow pace. The land which fell to the lot of this machine was undulating, the team small, and yet fair work was done Time, 54 minutes; weight, 1,000 pounds; draft, 248 pounds; cut, on trial, 4 feet 4 inches. Price, as a self-raking reaper, $175.

M'CORMICK'S ADVANCE.

This machine was entered by P. Mohan, of St. Louis. The fact of its having been entered at all is evidence that this trial was considered by his agent, if not by Mr. McCormick, of great importance to the trade, for it is well known that in this country at least, Mr. McCormick has relied upon his well earned reputation for the sale of all the machines he desires to manufacture. Mr. Mohan entered the contest with zeal, yet it was a new field to him, and consequently he was unable to make the machine do all it was capable of doing. The "old reliable" is a well earned title, by the durability with which it is constructed. Weight 830 pounds; draft, 329 pounds; time of cutting, 36½ minutes. Price, reaper, $150, combined, $190.

EXCELSIOR.

The *Excelsior* of Seiberling & Co., Akron, Ohio, was the next machine—a self-raker. It went quietly through its lot, without attracting much attention, doing good work, leaving its gavels in fair condition. Time occupied, 39½ minutes; weight of machine, 850 pounds; draft, 253 pounds. Price, $165.

MEADOW KING.

This was a light machine, entered only as a mower, by Gregg, Plyer & Co., of Trumansburg, New York. This was also a very late comer, and shared the common fate, perhaps for want of sufficient preparation and a little experience. It was new to us Westerners, but seemed to have many good points.

The Secretary cannot omit to notice a little incident which brought the *Marsh Harvester* again into notice:

Just at the close of the reaper trial, Mr. J. D. Easter asked leave of the committee to put on exhibition a new dropping attachment to the *Marsh Harvester*, which being granted, the inventor, Mr. N. S. Ketchum, of Marshalltown, Iowa, appeared with the attachment, which was readily adjusted in place of the platform supporting the binders, when the driver started off, leaving the gavels on the ground at any desired distance, in capital shape for the binders. This will make an excellent attachment, when cutting oats or grain too green to be at once bound.

The gavels are left on one side, out of the way of the next round. It is simple and cheap, costing not more than ten dollars to the user.

The committees report the following points made by the respective machines, as determined by vote:

REAPERS AS DROPPERS.

Climax, 98½; Clipper, 92½; Bucyrus, 87; Ætna, 84; Excelsior, 78; Champion, 74½.

REAPERS AS SELF-RAKERS.

Burdick, 91½; John P. Manny, 85½; Ætna, 84; Kirby, 82½; Excelsior, 78; McCormick, 75½; Champion, 74½; Marsh, 73.

REAPERS, WITHOUT REGARD TO COMBINATION.

Climax, 93½; Clipper, 92½; Burdick, 91½; Marsh, 88½; Bucyrus, 87; John P. Manny, 85½; Ætna, 84; Kirby, 82½; Excelsior, 78; McCormick, 75½; Champion, 74½.

REAPERS AND MOWERS COMBINED.

Clipper, 98½; Climax, 97½; Bucyrus, 94; John P. Manny, 80½; Champion, 78; Kirby, 77½; Ætna, 76; McCormick, 75½.

HARVESTERS.

The Marsh had no competition, technically considered. Points, 100.

WM. T. ESSEX, *Chairman Com.*

MOWERS.

	Draft.		Points.
Acme	204	pounds	87
Clipper	198	"	83
Climax	211	"	83
Kirby	215	"	80
Bucyrus	256	"	78
Champion	255	"	75½
Ætna	274	"	71½
Meadow King	266	"	70

W. C. FERGUSON, *Chairman Com.*
H. A. BRANDES,
THOS. WELDEN.

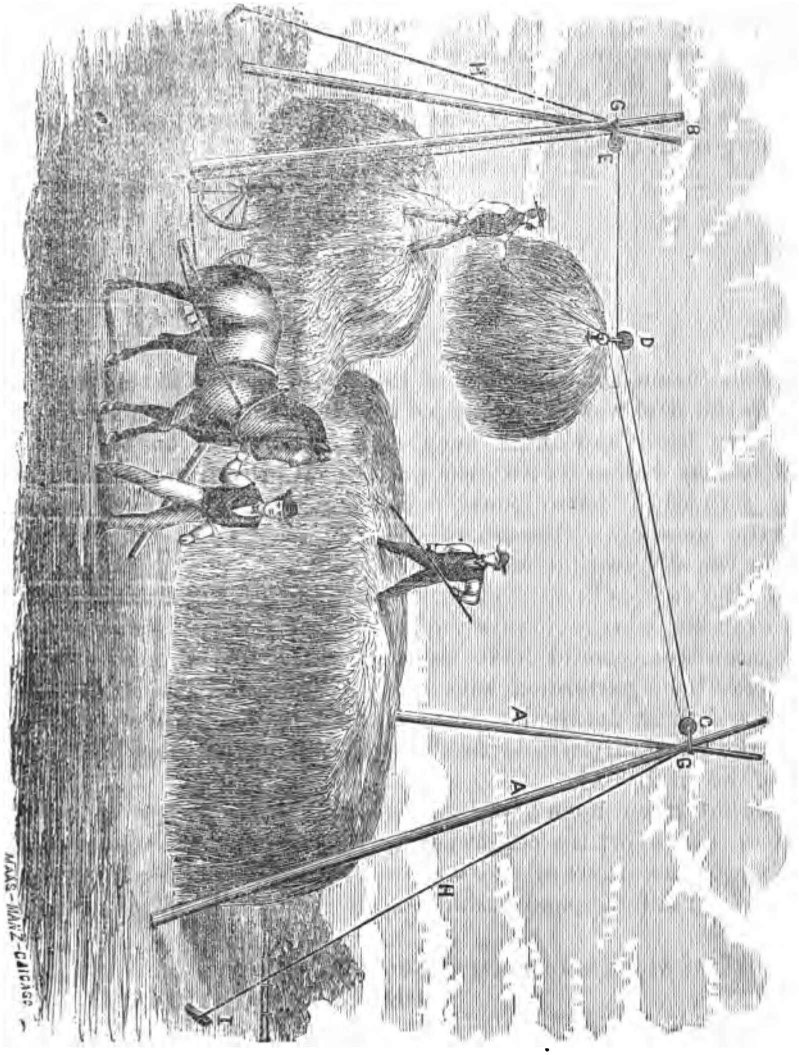
The following are the awards:
Best Harvester—"Marsh."
Best Combined Reaper and Mower—"Clipper."
Best Self-Raking Reaper—"Burdick."
Best Reaper—"Climax."
Best Reaper as a Dropper—"Climax."
Best Mower—"Acme."

TABULAR STATEMENT.

Machine.	Width of cut	Actual cut on trial.	Draft.	Time of cutting 9-10 acre	Weight of Machine	Price of Machine	Time required to change from reaper to mower
	Reaper	Reaper	Reaper				
Marsh		5 ft	270 lbs	36 minutes	870 lbs.	$195 00	
Clipper	6 ft.	5 ft. 6 inch.	235	41	875	190 00	10 minutes
Burdick	5 ft. 6 inch.	4 ft. 8 inch.	226	43	875	160 00	
Climax	6 ft.	5 ft. 2 inch.	203	37	800	150 00	6½
Climax	6 ft.	5 ft. 2 inch.	203	37	890	185 00	
Acme		4 ft. 8 inch.	204			125 00	
Kirby		5 ft	243	45	900	165 00	1
Champion		5 ft.	297	54	1000	175 00	5
John P. Manny		5 ft.	260	38	950	175 00	3
Ætna		5 ft.	327	35	900	142 00	6½
Bucyrus		5 ft. 3 inch.	256	35	750	145 00	4
Meadow King							
McCormick, Reap.						150 00	
McCormick, comb.		4 ft. 10 inch.	317	36½	830	190 00	19
Excelsior		5 ft.	253	39	850	160 00	

REPORT OF COMMITTEE ON HORSE HAY FORKS AND GRAPPLE. [See Illustration.]

The committee who were to witness the working of Rogers' Original Horse Hay Fork, with Nellis' improvement, repaired to the farm of Thomas G. Settle, Esq., near to that of Dr. Henderson, June 24th, 1870.



Two sets guy poles were erected, with a single pulley on each; the heighth of main guy pole from the ground was about thirty-five feet; that of the smaller one about twenty-five feet. A stack was made near the base of main guy pole. In order to use the fork above named, about 110 feet of ¾ inch rope are needed, and 100 feet same size rope for guy, and a snatch-block near the base of smaller guy. These having been adjusted, a load of hay, judged to be about fifteen hundred pounds, was unloaded in six minutes, and at five forks full, the fork taking it up quite clean. The second load, of same size, was taken up at four forks full and in five minutes.

In our opinion, the entire arrangement is a perfect success, and we are well satisfied that one ton of hay can be unloaded to the height of twenty-five feet in four minutes. In brief, we consider Rogers & Nellis' Harpoon Horse Hay Fork all that its owners claim it to be.

The entire fixtures necessary for unloading hay, under all circumstances, except the rope, is one fork, $15 00; one set grapples, at $3 50; one set pulleys, four in number, $2 60; floor hook, 25 cents; amounting in all to $21 35.

JAMES MOORE, *Chairman*,
G. L. ADIE,
D. G. JONES,
Committee.

In conclusion, the Secretary of the Board desires to remark, that although the trial was not managed in every respect as it might and would have been had there been more experience on the part of committees as well as on his own part, yet it proved in the main satisfactory to all the participants, because of the evident desire on the part of the members of the Board, its officers and the committees to meet out the strictest justice to all concerned.

Had the entries been made somewhat earlier, so as to enable the Board to judge more accurately of the labors required on their part, more committees would have been provided, and then the duties would have been performed with more system and ease to the committees, and their detailed reports could have been given, while at present the Secretary will be held responsible in the main for the account of the trial.

It would have been a pleasure to the writer to lay before the readers of this report the claims set up by other machines, especially those winning awards, but they were not furnished on the part of these last, while a limited space forbids more than has been given of the former.

All of which is respectfully submitted,

CHAS. W. MURTFELDT,
Corresponding Secretary.

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(2)

TRANSACTIONS

OF THE

MISSOURI STATE HORTICULTURAL SOCIETY,

AT ITS

TWELFTH ANNUAL MEETING

HELD AT ST. JOSEPH

ON THE 29TH NOVEMBER, AND THE FOLLOWING DAYS.

JEFFERSON CITY, MO.:
HORACE WILCOX, PUBLIC PRINTER.
1871.

REPORT OF

TWELFTH ANNUAL MEETING

OF THE

STATE HORTICULTURAL SOCIETY OF MO.

BRADY'S HALL, ST. JOSEPH, 29th November, 1870.

The meeting was called to order by President Clagett, and on his request Rev. C. J. Vandeventer opened the proceedings with prayer.

Mr. A. H. Vories said on behalf of the St. Joseph Horticultural Society he welcomed the Horticultural Society of the State of Missouri to the hospitalities of St. Joseph. There were no high emoluments attached to the officers of the State Society, and it was supposed that St. Joseph was selected as at least worthy of one meeting of this Society, from its locality and interest in horticulture. The failure of the apple crop was a disappointment to the St. Joseph Society, who would have liked to make a display of the apple products of our region. As it was, the specimens shown did not fairly represent the capacity of our soil. After some further remarks Mr. Vories again welcomed the members of the State Society.

President Clagett responded in terms complimentary to St. Joseph, and the surrounding country, returning the thanks of the Society for the cordial reception they had received.

Reports of Vice Presidents being in order, the following is the

REPORT OF HON. HENRY M. VORIES.

To the President of the State Horticultural Society:

The undersigned, as Vice President of said Society for the Seventh Congressional District of the State, would report as the progress of horticulture in said district, during the present year, the following:

The commencement of the cropping season seemed to be favorable; but, during part of the month of May and through the month of June, the weather was so extremely warm and dry as to create considerable alarm for the crops. But this drouth was broken up by copious rains which came in time to save the crops; and I might say that nearly all of the crops grown in this district yielded at least an average, as to quality and quantity of products, except as to some variety of fruit.

The vegetable crop was an unusual one. The finest cabbages, turnips, sweet and Irish potatoes raised for many years were produced last season.

The apple and pear crop was nearly an entire failure. We had a severe frost about the 16th or 17th of April, which destroyed the apples and pears, although a great many of them were then in bloom. The plum crop was also at the same time destroyed. Raspberries did finely; that is the blackcaps produced a heavy crop of fruit of an excellent quality, which was marketed in good order at remunerative prices. Strawberries produced a moderate crop, and, as usual, Wilson's Albany succeeded the best. Blackberries and currants were not successful. Cherries were principally killed by the frost referred to, which was the most remarkable severe freeze that has happened to this country for years. The grape crop was injured by the freeze, but not destroyed. The Hartford Prolific, Ives' Seedling, Diana, Catawba, Isabella, Virginia Seedling, and perhaps some others, produced a full and heavy crop, and where the vines were well cultivated and tended the fruit ripened evenly and was of unusually good quality. The Concord, Delaware, Dracut Amber, North Carolina Seedling, and some others, produced from one-half to one-third of a full crop, except in some favored localities, where the vine were young, they were better. Rogers' No. 1, or Goethe No. 3, No. 9, No. 15, and No. 19, produced a fair crop of good fruit. And so with the Salem. In fact, all varieties of grapes this season were of unusually good quality, ripened evenly and ten days or two weeks earlier than usual. The Catawba surpassed anything done by it for the last six or eight years. It bore a heavy crop, ripened well, and the fruit was unusually fine—better in quality and appearance, without either rot or mildew. The wine made this year in this vicinity, and that made by Mr. Ballinger, in Daviess county, on the bluffs of Grand river, is, or promises to be of a superior quality. The interest taken in fruit-growing in this district is unusually active, and from present appearances fruit will ere long become one of the principal productions of the country.

H. M. VORIES.

REPORT OF O. H. P. LEAR, OF THE EIGHTH CONGRESSIONAL DISTRICT.

To the State Horticultural Society:

The following items may be of interest to the Society:

Our apple crop was a failure as a whole, yet Northeast Missouri raised some partial crops, and, of some varieties, fair fruit. I will state my own case as an illustration—and it was as good as the best. Out of an orchard of 1,400 trees of three plantings, the last in 1860, I gathered 300 barrels of apples, many varieties of which rott d badly, the world-renowned Rawles' Janet the worst of any. I re-packed 14 barrels of Janets in St. Joseph, a short time since, that had been packed in good condition, with my printed cards on them as a recommendation, and lost four barrels out of the lot, and of fifteen barrels of Winesaps I only lost a bushel. The Janet seems to prove the truth of the Knight and Kendrick theories—that the parent tree is dead, therefore the general value of it is no more. It is no longer of any value as a market fruit, except on young trees. Here my opinion, as expressed in my last annual report, in relation to the damage done to our trees by the October frost, is more than realized. I have ordered one hundred and fifty trees to fill the places of dead and dying trees, and it will hardly be enough. The damage was general through this section. We had a partial peach crop of seedlings, with an occasional improved peach. Would it not be well for our Society to offer a large premium, to be awarded five years hence, for a desirable seedling produced here or in Kansas.

Pear culture is still a drag here. Blight, curculio, hard or changeable winters are the main drawbacks. Cherries are profitable as a whole; the common varieties and some of the finer ones do well. Our people do not cultivate them as much as they ought.

All the small fruits are a decided success, unless it is the blackberry, which we will not give up yet without further trial. The supply of small fruits is not nearly equal to the demand, owing partly to the rapid influx of people to Hannibal, and partly to the negligence on the part of some cultivators.

Grapes are more than a success, a description of which I will leave to my friends Westfall, Trabue and Payton, who are "grape men."

REPORT OF G. S. PARK, OF PARKVILLE, MO., VICE-PRESIDENT FOR THE SIXTH CONGRESSIONAL DISTRICT.

MR. PRESIDENT: In order to make as full a report as possible, I addressed a note to the leading fruit-growers in the various counties, asking for information. Some of them have responded fully and well, giving local facts and experiences, which I beg leave to submit with my report.

Our people are evincing a great and growing interest in the culture of fruits. Large quantities are being planted; and in a few years we hope to be behind no section. The past year has been hard on fruit men. The first two weeks of April were warm and mild; our fruit trees bloomed and set fine and full, but on the 14th a cold wave came down from the north and froze them hard, so we have no fruit only on late blooms. The sly old Janeton did not expand her bloom to the first wooing of the sweet southwester! She gave us some fruit. We find the Tetofky, Jeffries, Fall Wine, Janeton, Northern Spy and General Lyon bloom late, and usually escape late frosts. The pear shared the same fate as the apple. We had peaches sufficient for home consumption. Sometimes they have borne the best on northern descents, sometimes eastern, and sometimes on the summit. But this year they have borne the best on southern benches of the bluffs and on other sheltered situations, and, on the whole, experience favors the first benches on the south side of the bluffs. Strawberries were a light crop, owing to early drouths. The Miami Blackcap was most prolific. So with the Kittatinny Blackberry. Grapes fruited well, and were very abundant. Fruit is not keeping well, owing to insect depredations and early maturity, from extreme heat and late heavy rains. Apples sell readily in Kansas City at two dollars per bushel. They are importing from Michigan. The growing season has continued much later than usual. I found the young trees in my nursery on the 20th of November apparently growing, with leaves nearly as green as ever.

We next notice the

POMOLOGICAL GEOGRAPHY OF THE SIXTH CONGRESSIONAL DISTRICT.

The Missouri river wends its devious way more than one hundred and fifty miles through the centre of the district, forming two lines of bluffs rising from one to two hundred feet, which, with the bluffs on the numerous smaller streams, afford a large amount of this formation so favorable to fruit-growing. The immediate valley of the river is from two to four miles wide, and produces very good fruit, but is hardly equal to the uplands. The country back of the river is gently rolling, affording everywhere the finest orchard sites, so well drained that few trees have wet feet. Timber predominates on uplands, near the river, and as you recede back prairies alternate. Our soils are among the richest in the world.

Here the forest trees grow luxuriantly. We often find the oak and walnut more than 100 feet high, intertwined and festooned to their very tops with wild grape vines. So well is this soil adapted to the growth of fruit trees, that we find our two year old trees as large as those three and four years old in the Eastern States. The bluffs are broken and afford sites for orchards well sheltered and facing all points of the compass.

CLIMATE.

I have often observed in coming up the Missouri river, that after passing the mouth of Grand river and the Teetsaw plains, in Saline county, there is a change of soil. It is comparatively lighter and dryer, and of a rich black mould. The climate also seems to be dryer and there are more dry winds from the southwestern plains. Those soft, mellifluous winds, rushing up from Southern Mexico and turning the we tern extremity of the Ozark mountains, spread out over Western Missouri and Kansas. We have all the elements of the best fruit soil, and rains in the early season to perfect the growth and give a high specific gravity to our fruits, while the warm suns and the dry, soft winds that usually prevail from the southwest from July to October, give beauty and the highest flavor to our fruits.

My attention was first called to the flavor perfecting qualities of these soft and balmy southwestern breezes, by the unequalled deliciousness of some Bellflowers picked in September and hauled across the plains to Denver. The German who drove the ox-wagon said, "they is petter as goot;" and I must say there never was fruit more delicious. We find the Barbary States supply the merchant princes of Europe with their most delicious fruits, whose flavor was perfected by the warm dry winds from the Great Sahara. What delicious palms grow in the oasis of the desert! So the delicious peaches that grow on the southern slopes of the Great Allai range, in Asia, are perfected by the dry winds from the Desert of Ooli.

In Persia, too, the peach is still formed by the breezes from the sandy plains of the South. So the Assyrian Hills yield as fine fruit as ever Eve picked; on the mountains of Palestine clusters as fine as those borne from Eschol, for they are yet found as ever by breezes from Arabia Desert, passing over "Idumeas Spicy Forests."

With these historic facts before us, and the further proof that our fruits are unequalled in size, specific gravity, beauty and flavor—may we not justly claim that the banks of the Missouri can and will produce the most delicious fruits of America. Our chief difficulty will be our changeable climate in winter and early spring. The Gulf stream from the tropics rushes through its warm vapors over us which often starts sap and early vegetation prematurely; while on the north an open and almost treeless plain extends to Baffin's Bay and the North Pole. The Garden of Eden was protected on the north by Caucasian mountains. The fine peach valleys of Persia, by the Oronto, and the fruit hills of China, by the Atlas ranges. But we have nothing north of us to check the cold wave coming down to blast our tender buds and opening blossoms, called into life by the warm south wind. We can only remedy this in a measure by selecting fruits least susceptible of change, but at best we shall occasionally suffer loss.

The sudden freeze in April last did not injure the peach so much as it did the apple, the pear and the cherry. I had a proportionately larger crop of peaches. Sheltered situations and the southern beaches of the bluffs produced the most. Sometimes we have the best crops on the northern exposures. This is probably owing to the peculiar and accidental condition of the tree at the time. In 1856, when most of the peach trees were killed by the intense cold, I had peaches on a high, poor point. Hence I have come to the conclusion that it is not so much intense cold that kills our peaches as the sudden changes of temperature, when buds and wood are not prepared for it. An early or sudden frost in autumn or late in the spring, or a warm spell in winter, followed by a hard freeze, injures the trees and kills the tender life of the bud. We should then temper the growth of trees so they may be prepared for all those changes.

POMOLOGICAL GEOLOGY.

The counties in this Congressional District extends east and west nearly 150 miles on either side of the Missouri river, consequently they have extensive bodies of Loess or bluff formation, differing somewhat in the ingredients that form the basis of the soil and subsoil. There is more sand near the river than further back. The surface soil is of a light kind and rich for the depth of eighteen inches or two feet, full of humus and the phosphates, and a sub-soil of marly clay, in which silica predominates in the bluffs, and clay as you recede from the river. Potash, nitre and carbonate of lime abound everywhere, with stratas of limestone. The Loess formation of marl is so porous that the roots of the trees penetrate to great depth. In a recent railroad excavation I found Osage Orange roots had descended fifteen feet. They had been planted but fifteen years, and so had run down a foot a year.

Wheat and clover grow well in this subsoil after exposure to the atmosphere. I saw a Ben Davis apple tree growing evenly and well on this subsoil, and bearing profusely where the entire surface soil had been removed to the depth of three feet. Back from the river the marly clay subsoil becomes stiffer, and the surface soil deeper, with an abundant supply of phosphates, iron, ammonia and carbonate of lime, for the growth of fruits. Everywhere we find the soil and subsoil contain all the elements that form the best fruit soils. It has the power to retain moisture, and combines all the elements for the growth and maturity of our standard fruits. The capacity of these soils is practically shown by the noble fruits they produce, unsurpassed in size, beauty and flavor, and these peculiar formations and soils in Platte, Clinton, Clay, Ray, Carroll, Jackson, Chariton, Saline, Lafayette and Caldwell counties must soon command attention, and take a high position in the horticultural world.

NEW FRUITS.

We next proceed to notice the new fruits of this section, giving the result of our experience to the present time. Some time is required to determine fully the merits of new fruit, and after further experience some of these statements may need revision. There are many agencies that affect fruit. Its quality and hardihood depend some upon the stock upon which it is grafted. There are great variations in different seasons on different soils and in different situations, even if grafted on the same tree, one of them may be more adapted to the stock of the tree, than the other, thereby monopolizing more than its equal share, and dwarf the others. Some pears will not grow well on the seedling, and require twice budding to get a congenial stock. While Van Mons selected the hardiest seedling to improve by successful reproduction, believing the high qualities of fruit would deteriorate in its seedling, and not possess the vitality of the hardier seedling. While Mr. Knight would fertilize by artificial impregnation, upon the same philosophical principle we improve our domestic animals by judicious crossing. We have, without their experience of philosophy, trusted to nature's own mysterious operations, and sought for more perfect fruit among the wildings.

We believed a soil and climate that produced such superior fruits must produce superior new seedlings. If the rich pastures in the valley of the Teeswater produced the Durham stock, why may not the valley of the Missouri, with its superior fruit soil and climate produce new fruits superior to any yet handed down to us by our Pomological Fathers? We do not look to Liberia or the lowlands of the Gulf to find a Baldwin or a Rhode Island Greening, or a Lawver. But we find them here. In an early day fruit trees were scarce, and the early settlers planted large and perfect seeds from their noble fruits, and among these we find some fruits of unsurpassed excellence. We are gratified with their health and vigor. We have a fresh young race free from weakness and deterioration. Too often the stock upon which we graft our fruit in continued succession is grown from imperfect seed. The vital principle in plant as well as in animal continues the same through life, and is strong or weak, according to its original vitality. Diseases of the human family are handed down from father to son for ages. The same laws will hold good in fruits. Is not the seed from which we grow apple stocks taken from immature apple culls, piled up and used for making cider, being fit for little else, and poor for that? What would you think of a stock raiser who breeds his stock from weaklings and scrubs? It is a fact, worthy your consideration, that most of the old varieties of budded peaches bear but little, while seedlings bear by their side fully. May not repeated buddings on feeble stocks produce this change and transmit barrenness to all the stock? The simple act of budding does not deteriorate, for I budded a seedling by mistake and it bore heavily.

South of the Apalachian Mountains in Georgia, and in the southern valleys of the Ozark range in Arkansas, we find a few deserted peach trees, and they are there constant regular bearers. I have sent to these sections for some thirty new varieties, which I am budding with fair hopes of successfully raising more regular and prolific bearers; and might it not be advantageous to procure seed for stock from these healthy peach sections? Nor should we neglect to collect our own best seedlings and plant seed from our most hardy trees.

APPLES ORIGINATING IN THIS CONGRESSIONAL DISTRICT.

Most of them are taking high rank among our standard fruits. "Lawver" originated on the farm of Henry Burichter, about two miles from Parkville, Missouri, from the seed of a large red apple taken out of the apple and planted about fifteen years ago by his wife beside a stump, near the first log cabin. It grew up and Mr. Burichter thinks it bore in four or five years from the planting of the seed. It had several mishaps, but finally grew up and formed a handsome tree. It has borne ten or fifteen bushels of fair fruit every year for the last four or five years, till this year, it set full, but the young fruit was destroyed by the frost. It is hardy and grows very thrifty in our nursery. We have bought the scions and apples for distribution of Mr. Burichter. The apples usually sell for double the price of other apples. The *Prairie Farmer* says "it is one of the most beautiful apples we have ever seen." Judge E. H. Norton says: "no description or painting can equal the reality."

Our most prominent fruit growers are unanimous in awarding it the standard in beauty and flavor. Dr. Warder speaks of it as one of the best of the season. Fruit large, bright, dark red, smooth and glossy, flesh white, sometimes brightly stained with red, crisp, slightly aromatic, rich cranberry flavor. Tree thrifty, hardy and of fine form, popular with the train boys, sells better than oranges.

Missouri Superior.—First found in Clay county, resembles large striped Pearmain, will keep longer. Tree a thrifty grower, prolific bearer, and much sought after by fruit growers for marketing late in the spring; profitable fruit, very large, dull striped with red, sub-acid, very good.

Huntsman's Favorite.—First propagated at Lexington, Lafayette county, though we believe Johnson county claims the original tree. We wrote to parties interested for a distinct and correct history, but have not yet received an answer. Tree is a fine grower, heavy and regular bearer, fruit large; yellow, red blush; best quality; a few in a drawer will perfume a room. I learn that the original tree has not failed to yield a fine crop each year for the last twenty-two years. I have not heard from them this year; it keeps till April.

Park's Keeper.—Thought by many to be the large striped Pearmain or McAfee's Nonsuch, but we cannot find that those apples keep so long. It keeps well into June. It may be a seedling, as some apples more nearly reproduce themselves than others. At any rate, without regard to name, we know we have a valuable apple. It has been shipped in the spring to the Yellow Stone and Fort Benton successfully; is very

very valuable in June and July; retains its fine flavor; the fruit large and yellow, covered with crimson stripes and splashes of bright red, beautifully mottled and shaded with a yellow bloom, presenting a splendid appearance in the market; ranks among our most valuable keepers; rich, sub-acid flavor, free and rapid grower; rich yellow roots; stands a head and shoulders above any other apple in our nursery. It is A No. 1 so far.

Hardwick, From Hon. Sam. Hardwick, of Liberty, Mo., (who takes great interest in horticulture). Originated in Clay county; fruit of fine appearance; a very long keeper; fine quality on trial; promises well ; free and hardy.

Ella Park, originated near Parkville, Platte county, Mo., one of the apples from which the plate was drawn was fifteen months from the picking. It easily kept over summer; it is of a bright red, a little larger than the Janeton, roundish oblate, of great beauty, a brisk sub-acid, very good in spring and summer, very saleable, tree hardy, thrifty and productive—exceedingly promising.

General Lyon, a seedling of the Ben Davis, planted by the late Elias Jacks, a practical fruit-grower of Platte county, about three miles from Parkville; size, between the Janeton and Ben. Davis, quality, is better than its parents, tree growing in my nursery resembles the Ben. Davis, same thriftiness and hardihood, fruit greenish, red and yellow ground, a very long keeper; the apples have been kept till harvest without any sign of decay. The original tree began bearing very young, and has borne heavily every year since. Its value is greatly enhanced by the fact that it bore this year while the fruit on most other trees was killed by the frost in April last.

Todd's Sweet, grown by Marion Todd, Esq., a practical and extensive fruit-grower of Platte county. This fruit is large, striped with red, and of delicious flavor. Keeps well into the winter; tree thrifty and productive. On trial. Very promising.

We have a large list of new apples, originating here, from the South and West on trial.

Mr. Dan. Carpenter, an enterprising horticulturist on the line between Platte and Clay counties writes substantially as follows:

"I have not been able to get full statistics. Nearly the whole are within three miles of Barry, on either side, in both counties. 3,898 apple trees were set out in the last two years, and there are in the same space, 6,163 bearing trees, 2,498 over two years old, and not in bearing, making a total of 12,559 apple trees in six miles square, and 938 pear trees, 2,382 peach trees, all seedlings, and 752 cherry trees, and 60 grafted plums. No attention was paid to small fruits. Grapes —about two acres. Fruit—a total failure this year. I have about fifty fig trees growing handsomely, and I feel confident of success. One year more will decide it. Concord grapes do well. Hartford is most prolific, and so far is best. Clinton is unworthy of cultivation, and I shall discard it. Norton does well for wine. Delaware, Ives and Catawba promise well. Mary Ann and North Carolina grow finely, and are hardy so far. I am growing raspberries, blackberries, strawberries, whortleberries, currants and will plant cranberries, and mean to propagate every variety of fruit grown in the United States, I have successfully grown pea-nuts with little labor. I have no colaborers here to council with, yet I feel confident we may successfully grow many of the tropical luxuries sufficient for family use with but little extra care and labor."

Respectfully,
DAN. CARPENTER.

Nov. 19th, 1870.

Mr. O. P. Moran, Converse, residing east of Lathrop, Clinton county, near the line of Caldwell county, one of our most experienced and practical fruit growers, reports as follows. His statements will apply generally to both Clinton and Caldwell counties:

"Dear Sir: Yours, asking answers to the following questions to hand, and in reply will say: 1st. That the number of fruit trees planted within the past two years would be a hard thing to approximate, but they are many thousands. The number of railroads built, and others in course of construction through the country, together with the great advantages we enjoy of a central location, and soil and climate peculiarly adapted to fruit-growing, has caused a rush of immigration to come in, and all, or nearly all, either for market or family use have planted fruit trees and vines within the past two years.

2d. All the older settlers have bearing orchards, some only enough for family use, others a few for market, while another, Mr. Thomas E. Turney, one of them, near Turney station, has planted very extensively.

3d. Pears have not been planted very extensively, but those planted and properly cared far, have proved healthy, productive and remunerative. Peaches are not so sure a crop, and consequently do not receive very much attention, farmers only planting a few for family use. I might say about the same for such of the smaller fruits as raspberries, blackberries, strawberries, gooseberries, currants, &c. Grapes at this time are receiving more attention than any other fruit.

Our soil and climate seem so well adapted to grape-growing that all are planting for home use, and many for market and wine. About fourteen years ago I sent to Rochester, N. Y., for a lot of fruit trees and vines, among which I received one Concord vine, probably the first Concord vine ever planted in Clinton county. It came into bearing the third year, and I was so much pleased with it that I commenced propagating to increase my number of vines for family use. In a few years I had nine vines bearing. I took the grapes to St. Joseph and sold them for $53. I considered this profitable for nine young vines, and concluded to raise more of them, and have done so.

I have sold a large number of them, and planted largely of them, both for home use and market. I have seven acres now planted in vineyard. The old vine is as vigorous, productive and healthy, as it ever was or any of my younger vines. I have gathered as high as 70 pounds off of vines five years planted, but I think it is more than three times as much as vines should be allowed to bear annually.

My practice is to plant 8x10 feet, 500 vines to the acre, and allow them to bear about an average of twenty pounds to the vine, or five tons to the acre. The average price received this year, wholesale, was about 10 cents per pound. I have tried, and have on trial, all the newer varieties, and old ones, too, that have reputation. The Catawba is healthy with me, but ripens too late most seasons; it is ripe this year and very fine. Hartford, healthy and productive; Virginia seedling, all that could be desired for red wine; Ives, not in bearing; Martha, promising, but too young to form an opinion of; Rogers' hybrids, the same, and also Herbemont; Delaware, on its own roots, a poor grower, but grafted on strong roots, a rapid grower, but has not borne.

I have given considerable time and attention to raising seedlings, and hope I have not been entirely unsuccessful. The great merits of the Concord as a table grape, and the Catawba as a wine grape, and feeling the want of something that would keep, handle and ship better than the Concord, have better quality, be more productive and healthy than the Catawba, I determined to try what a cross between them would produce. I have now a great number of such seedlings bearing, one of them that I hope will be valuable as an early market grape. It is a regular Concord vine, the bunch very compact, not quite as large as the Concord, about the same quality, ripens all at once, and before the Hartford. There are branches hanging yet (23d of September), in all their perfection. I have, as a result of the Catawba cross, fine, white Concord seedlings, all distinct one from another, but all more or less promising, and all delicious, sweet and rich. I have two seedlings from the same grape; the one a dark purple, almost a black, considerably larger than the Concord, ripens with it, is sweet and rich from the time or before it is fully colored. The other, a regular Concord vine, bunches large, nearly the color of Catawba, and larger than Concord, and quality I think superior to either; to all appearances entirely healthy. This grape I have high hopes of, but fear it will be troublesome to propagate, as the cuttings from it last spring all failed to grow.

The following I mention as the most desirable, all things considered, of the various kinds of fruit, according to my experience and observation:

Apples for winter—Janeton, White Winter Pearmain, Winesap, Fall Rambo, Maiden's Blush and Fall Janeton. Summer—Red June, Sweet June, Early Harvest. Pears—All pears have proved healthy, and most of them productive. With me, Bartlett, Angouleme, Flemish Beauty, White Doyenne, Easter Beurre, Vicar of Winkfield, Lawrence, Gray Doyenne, Beurie D. Amanlis and Buffum are all to be highly recommended. Of grapes, the Concord, Hartford, Virginia, and Cynthiana stand first among old varieties, but we hope something better.

The Wilson Strawberry is the best I have tried.

would be much pleased to be at your coming meeting, and will if business does not prevent, but can make no show of fruit, as grapes will be gone, and apples and pears are a total failure here this season for the first time since I have been here, 17 years. If you should at any time pass this way, call and see what I have got, and what I am doing, and how I do it.

Respectfully yours, &c.,

O. P. MORAN.

Mr. J. J. Funston, an enterprising dealer in fruit trees, reports for Ray county, that 150,000 apple trees have been set out in the past two years. There are 200,000 bearing trees in the county. Average price of apples, 75 cents per bushel. They ship largely up the river. There is no nursery at present in the county. Mr. Riggs had a nursery in the county about 30 years ago. He sold mostly Janeton, Summer Green, Carolina June, Fall Wine, Fall Pippin and Yellow Belleflower. These have been productive and hardy. Those recently planted are as follows: 30,000 Janetons, 7,500 Ben. Davis, 12,000 Wine Sap, 15,000 White Winter Pearmain, and about 37,000 other varieties. About one-fifth of the whole sales are Janetons, 30,000 fall varieties and 30,000 summer varieties.

Pears.—18,000 pear trees have been planted in the past two years, mostly Bartlett, Flemish Beauty, Duchess, and Louise Bonne de Jersey.

Cherries and Peaches.—About 4,000 have been planted, mostly Early Richmond, early and late Heath Cling, and a few Early York and Old Mixon.

Grapes, 50,000 have been planted, mostly Concord; strawberries, 30,000; raspberries, 30,000, mostly Philadelphia; blackberries, 500; currants, 3,000, mostly cherry; Osage plants for hedging, 500,000 have been set out in the county. In all, 155,260 have been sold in the past two years. Increased attention is being paid to the culture of fruit in this great fruit region.

Respectfully,

J. J. FUNSTON.

REPORT OF GRAPE RAISING IN JACKSON COUNTY.

Having been raising grapes for the last twenty-five years, we will give you some of our experience, and also the number of acres under cultivation in the county. It is estimated at something over 100 acres, chiefly Concord, Norton Virginia Seedling, Hartford Prolific and some of the newer varieties which promise well. We now have six acres mostly all in full bearing, and somewhere between two and three hundred new varieties, such as Goethe and Martha. Our first planting is mostly Catawba, with the exception of one and one-quarter acre Concord, and about 160 vines of the Norton Virginia Seedling, Rulander, Herbemont, Ives, Hartford, Louisiana, Cynthiana, Maxatawny, Wilder, Walter, Hermann, Cassidy, Cunningham and Astralian. Those last named varieties have not fruited sufficiently to test their merits. Our crop was cut short this year on account of late frosts and a severe hail storm in May, which stripped the vines, and they suffered a great deal from the insects while in blossom. Part of our vineyard is differently located. About three acres escaped the hail storm, and from that we made 750 gallons Catawba and 400 gallons Concord, 80 gallons of Norton Virginia Seedling. Goethe and Herbemont were killed by the frosts of April.

G. & A. HARMUNG,
Grape Growers.

REPORT OF PROF. SWALLOW.

AGRICULTURAL COLLEGE OF MISSOURI,
COLUMBIA, Nov. 20, 1870.

Hon. Geo. S. Park:

MY DEAR SIR: In answer to your note asking me to give the facts developed by the geological survey respecting the adaptation of the soil of your district to the growth of fruits, I can only give you a general view, as it is not possible for me to find the time to examine all the notes of the survey to select these facts in detail.

Since my daily duties in the Agricultural College occupy so much of my time, I am now preparing and delivering to my class, a course of lectures on the climate and soil of Missouri and their adaptation to the various staples and fruits of the temperate clime. When I shall have reached the matter you desire, I will gladly furnish it. In the meantime it may be well to state such general principles as are fully established, and may be stated in a few pages.

Ever since my first examination of the soil of Western Missouri (in 1853), and the rocks from whence its wonderful fertility and durability are derived, the impression has been very strong that there is no region on the continent which has so good and so durable a soil as yours. Such are the elements and such their quantity in the marly subsoil that one can scarcely conceive any process by which the soil can be exhausted, if subsoiling or deep tillage be adopted.

The following is an analysis of a soil selected as a fair sample from your district. It had been cultivated for several years in corn, wheat, tobacco and hemp, and had received no dressing of any kind, and no culture save the ordinary plowing, eight to ten inches deep. The subsoil had never been disturbed. Column B gives its composition as nature made it at a depth of eighteen inches below the surface. And the column A, as it was in 1853, eight inches below the surface. The soil and subsoil are placed side by side for easy comparison. The soil marked A was taken from a depth of eight inches, and the subsoil marked B was taken from a depth of eighteen inches.

In 100 parts dried	in A.	in B.
Organic matter and water	5.0470	4.2936
Insoluble in acid, silica, etc	88.1600	84.2900
Chlorine	0.0075	0.0050
Sulphuric acid	0.0000	0.0300
Silica	0.3131	0.2940
Peroxide of iron	2.5135	4.6030
Alumina	2.5300	4.5968
Lime	0.6205	0.5152
Magnesia	0.5262	0.7875
Alkalies as chlorides	0.6670	0.6705
Phosphoric acid	1.1985	0.1817

This soil, rich as it is in all the necessary ingredients to render it most productive, was selected from a corn field by your suggestion, I think, as a fair sample of the soils of the Platte purchase. It was deemed no better than the average. With this fact in view, and the rich proportions of phosphates and alkalies in it, one can have no doubt that the soil in your district contains in great abundance all the chemical qualities needed for the most successful fruit culture.

But the physical structure of a soil is quite as important as the chemical. A soil may have an abundance of all needed fertilizers, and yet be so cold and impervious to heat and air that very little plant food can be digested and prepared for absorption by the roots of plants; on the other hand a soil may be so loose and pervious that water percolating through it carries off the plant food in such quantities as to exhaust the soil more rapidly than constant cropping. But the physical structure of the soil and subsoil of your part of the State has no parallel, save, perhaps, in the valley of the Rhine—so famous for its fruit culture. This is due to a deep bed of silicious marl above all the solidified rocks and the boulders of the drift and gush beneath the soil, to which it gives its chemical and physical character. The composition of this marl is all we would have it, as the basis of the best possible soil, and its physical structure is most suitable for that purpose. In its chemical composition it greatly resembles the marls called loess, in the valley of the Rhine, which has been for so many years the basis of a soil renowned for its wonderful fertility and its adaptation to fruits and the production of wine grapes.

The Loess of the Rhine contains carbonate of lime, silica, alumina, iron, magnesia, potash and soda, in large quantities, making it invaluable as a basis for a fertile soil, since these substances joined to the humic and phosphoric acids derived from decayed plants and animals furnish all the ingredients most needed by the staple crops and the fruits of the Temperate Zones.

The bluff formation or the bluff-colored marls which underlie the soil in all Northwestern Missouri, and which is so conspicuous in the bluffs of the Missouri river from Sioux City to St. Louis, has all the ingredients of the Loess, based upon this formation all along the Missouri, are soils unsurpassed for the staple crops, and the numerous larger and smaller fruits of this latitude.

This marl bed underlies all Northwestern Missouri and Northeastern Kansas, Western Iowa and Eastern Nebraska, and has a thickness varying from twenty feet to two hundred in depth. At St. Joseph it is one hundred and forty feet deep. It contains an abundance of silica, soda, potash, lime, magnesia, iron and alumina. On the rivers in Western Missouri it has enough fine sand to make it sufficiently pervious and light to supercede the necessity of under-drainage, and to fit the soil based upon it to withstand our summer droughts and drain off all superfluous water in the wet seasons. All of these materials are in a fine pulverizing condition most suitable for plant food. Such is its fitness for this purpose that even without the mixture of decayed plants and animal matter so necessary to soil, this marl, when exposed to the air and heat produces luxuriantly. In 1853 I saw corn growing on some of this silicious marl thrown from a well at the depth of sixty to seventy feet. The seed fell upon it accidentally, and grew without culture or care of any kind. It was fourteen feet in height, and had three large ears on the stalk. So well, in fact, is it adapted for a subsoil, that plant roots penetrate it for food and support to great depths. I have traced the roots of the white oak and the poke root into this marl to the perpendicular depth of seventeen feet. But the soils actually formed upon these silicious marls in the Platte county have every desirable quality, and also so well balanced as to fit the county for the culture of the largest range of crops. There is probably no region of this country which has a soil so rich, so deep, so well founded for durability, and so well adapted to so wide a range of culture as the soil of your Platte county. It has lime and phosphorus and silex enough for wheat, humus for hemp, sand enough for sweet potatoes, and phosphorus enough for the grape, soda enough for clover, and warmth and drainage and all the plant food needed to perfect all the fruits of the temperate zone. The grape delights in its warm, rich, calcareous depths. The only fear is its roots may find too much food for some varieties of vine. The apple, the pear, the peach, the plum and the cherry grow luxuriantly—often too much so in new land—and ripen large well flavored fruit.

Very respectfully,
Your obedient servant,
G. C. SWALLOW.

REPORT OF D. S. HOLMAN—FOURTH CONGRESSIONAL DISTRICT.

President and Gentlemen of the State Horticultural Society:

In reading the report of your proceedings in your last annual session, I find with some surprise, that I am Vice President of the Fourth District. Appreciating the honor and pleasure of the relation, and knowing it means *work*, I would at once proceed to report at your approaching meeting the horticultural condition and prospects of this district.

I regret that the severe frost of last fall and the unusually late frost of last spring must cause my report to be meagre. The apple crop was cut back to about ten per cent. of the usual yield in the district. Polk county perhaps produced more and better apples this year than any other county in the district.

Peaches—Though usually abundant here, were almost an entire failure in every county—were not pits enough raised for the nurseries. The trees, however, escaping injury and made good growth, are now well set with abundant fruit buds for another trial.

Pears—From the same cause were very scarce, such varieties as have been tested here. Bartlett, Osbands' Summer, Bloodgood, Flemish Beauty, L. B. De Jersey, etc., do well. Blight appears most with those who cultivate excessively—success appears to be with an intermediate treatment which ignores both neglect and overwork.

Plums and Cherries—Were also killed in bud. Wild plums are abundant. The cultivated varieties also fruit well, and are being planted to a limited extent, with a declaration of war upon the Curculio. Duke and Morella cherries succeed with us, but Heart and Bigarreaus do not endure the sun and frost of February.

Small Fruits—Strawberries grow on our prairies by thousands and millions. Old farmers thought them good as the best, but a few beds of Wilson, covered with berries, have been a strong argument and has worked a change. Wilson is our best berry in the dry soil of this region.

Blackberries—Grow wild in greatest abundance, and are really delicious. Notwithstanding this, Kittatinny, Lawton, and others are being planted.

Gooseberries—Do well; Houghton's Seedling is mostly grown.

Currants—Are less fruitful here—require screening and mulching.

Grapes.—The common varieties succeed well; Concord, Hartford, Delaware, and others, so well that a "forward movement" is made on grapes. Old vineyards are enlarged for profit; new ones are planted with tried varieties, and many of the new ones are put on trial. Though the grape crop was shortened some by the frost, it was a success. Never saw better Concords, though they rotted a little for a few days; Hartford did well; Delaware fruited heavily, and ripened almost perfectly; Clinton rotted badly and lost its foliage; Norton's Virginia fruited well, never looked better, ripened perfectly. Besides these we saw fruiting: Martha, Perkins, Gasconade, Rogers No. 1, or Goethe, Ives, Carolina Seedling and Black Hawk, with many others, in Greene county, showing fine fruit and giving promise of success.

Notwithstanding the failure of most fruits with us this year, the increasing interest in horticulture still increases. Tree planting goes right on at the rate of about 100 per cent. per annum, and about so of grapes. We have a broad, well-adapted horticultural field just being planted. Other sections of the State are well adapted to hemp, corn and tobacco, but ours is made for fruit. Its altitude gives us nature's healthful breathing of a balmy, pure, dry atmosphere so favorable to the perfect ripening of fruits. Our situation is between extremities sufficiently remote from both as to give us a climate favorable to all fruits of a temperate climate. The apple of the North and the peach of the South cast with us their shadows together and drop their ripe fruit in friendly piles in our Ozark orchards. The soil is well suited to most fruits which thrive in a dry mellow earth; made free from surface water by an under-bed at suitable depth of draining material, which, though crude, is superior to tile or trenching, secures to the tree a smooth bark, a good growth of ripe wood, regular fruiting and long life.

There is within the district one horticultural society, denominated "Greene County Horticultural Society," whose regular meetings are in Springfield, monthly. This is thought to be exercising a favorable influence in favor of horticulture.

Wishing for you a pleasant and profitable meeting,

I am, very respectfully,

D. S. HOLMAN.

SPRINGFIELD, Mo., November 25, 1870.

REPORT OF RICHARD BARRON ON ORCHARDS.

MR. PRESIDENT: Having been appointed chairman of the Committee on Orchards, I beg leave to submit the following report:

I cannot at this time enter into an extensive detail on the subject of fruit culture, as my practice and experience in horticultural pursuits are very limited, not having given it any consideration until within a few years past. First, the apple may be considered first in importance in the catalogue of fruits, and is claiming more attention from the agricultural community than any other known variety, perhaps the grape excepted, which is not now in my province to talk about.

From all the information I can gather, the apple crop this season has proved a failure all through this county, and generally throughout the State, with the exception of some few localities. In our county I do not think there is a sufficient supply for home consumption. The old planted orchards have all nearly failed from some cause or other. A great many persons attribute the failure to the cold snap we had late in April last; it may have had something to do with it, but I did not think at the time the buds were sufficiently advanced to be affected by the cold.

The spirit of planting still continues to progress. In our immediate vicinity several large plantings have been made within the last two or three years. The cultivation given varies according to circumstances. Most generally the young orchards are cultivated to corn and wheat alternate years; very frequently two years in succession to wheat. Those who have had large experience in the cultivation of the apple can the better judge of such cultivation being judicious or otherwise; I presume it is better than no cultivation. I cultivate alternate years to corn and wheat. I am obliged to do it, and I observe that my small plantation of trees make a much more vigorous growth the year they are cultivated to corn than when cultivated to wheat.

The insect called the borer has troubled my trees but very little—not more than a tree or two have been disturbed by the pest; but it is becoming more numerous and more troublesome in our section of country. It has destroyed a dozen or more trees in a young orchard near by. Previous to the last two or three years it gave no trouble, consequently it was not taken into consideration by tree planters.

The Peach.—Although one of the most delicious of fruits, and claims the admiration of all, yet it is not very extensively cultivated our neighborhood, and I may say county. We have some fine locations, too, along our Missouri bluffs, to grow the peach, and I presume it would be profitable to those who have these locations, provided the trees were planted and cared for properly; but, like the apple, it too has failed to yield us its increase this season, though at one time it gave promise of an abundant crop, yet it yielded to the untimely frost, and disappointed our fondest anticipations.

The theory of budding or grafting the peach on the plum stock, to secure hardiness and to insure an annual crop of fruit is, in my opinion, altogether a humbug—that is, so far as my experience goes in that direction proves it to be. I have two bearing trees growing on plum roots, which I budded myself, and I know whereof I affirm, and they only bear when others bear, and always fail when others fail. My object in trying the experiment was to have peaches every year, provided the theory given was true to promise. I could have peaches regular on my low location the same as they have them on the high locations around, but it will not do.

The pear, plum, quince and cherry are all cultivated to a very limited extent all through this section of country.

The pear is coming more into notice and favor, and the limited quantity I see growing around look to be healthy and free from blight.

The only blight I have seen was on a little tree of my own of the Canandaigua variety; this season it was affected a little—very little—with the blight.

Plums, all that are grown, or nearly all, are of the common varieties of the country—some few of the better kinds now and then; and, as far as my knowledge extends in regard to it, the curculio has undisputed sway over them, and there is none who rises up to contest his assumed right to the plum. Should there be a tittle of the fruit left from his ravages, it is partaken of with thanksgiving. From what I observed last season, I am inclined to think the little Turk (as familiarly known) is extending his line of attack into other domains. The peach last season was not exempt from its ravages. There was a great deal of imperfect fruit, caused by the sting of some insect, and the curculio was strongly suspected of doing the mischief. We are not disposed to accuse any living creature wrongfully, but facts point in that direction. The time appears to be approaching when it will be necessary for the Horticulturist to call into requisition the hog (wherever it is practicable) to assist in this war of extermination of the insect kingdom, for they are greatly on the increase wherever fruit trees are planted, and all who would have perfect fruit must try and provide some remedy against the depredators.

The above report I respectfully submit.

RICHARD BARRON,
Chairman of Committee on Orchards.

It was, on motion, resolved that the annual address be postponed till evening.

Adjourned.

EVENING SESSION.

On taking the chair, the President delivered the following address.

PRESIDENT'S ADDRESS.

LADIES AND GENTLEMEN: In this, our twelfth annual meeting—many of us from distant parts of the State—we should rightly appreciate the objects of our meeting, and take measures best adapted to attain the end proposed. The object we take to be threefold; our individual improvement, the collection and dissemination of information for the improvement of our fellow-citizens in the art and science of horticulture, and that we may co-operate in developing that branch of the great resources of our State, and co-operate with the friends of horticulture in other States in extending its refining, healthful and elevating influences throughout our country.

Presuming that happiness is the aim of all, the question comes up, what pursuit in life is best adapted to attain the highest and purest enjoyment?

If a capacity to enjoy and the means of enjoyment are essential to a high degree of happiness, then horticulture will take no second place in its adaptation to secure the highest enjoyment. It brings into exercise and develops all the faculties of the mind. We can only glance at the vast field of thought it embraces. It developes the most natural and healthful tastes. It brings us to a knowledge of the finest and most healthful flavors and delightful odors, and cultivates a love for and enjoyment of the beautiful and sublime, and at the same time furnishes the means for their enjoyment.

In a word, when rightly entered upon, it gives us a comprehension of the life that now is, and prepares us to comprehend and enjoy that which is to come.

Our creator was the first horticulturist. He planted for man a garden, and gave it him in charge to dress and keep. But being seduced by falsehood, his tastes became corrupted, and he was sent forth from fruits and flowers to toil among briars and thorns for daily bread. But the prophet promises us, as we return to truth and righteousness, the crooked shall be made straight, the rough places smooth, and briars and thorn shall give place to the box and the myrtle, and the land shall again bloom as the garden of Eden, and man shall again be happy in the enjoyment of fruits and flowers.

We find in all ages the cultivation of the garden has kept pace with the elevation and refinement of man. The wisest and best men have ever been its votaries. Noah planted a vineyard; Solomon sang of fruits and flowers, he went down into his garden of nuts to see the fruits of the valley, and to see whether the vine flourished and the pomegranates budded. Our Savior constantly drew his illustrations of divine life from the vine, fruit trees and flowers. And his beloved disciple John, who was permitted a sight into our future home beyond the dark river, "saw there a tree bearing twelve manner of fruits and yielding her fruits every month, and the leaves of the tree were for the healing of the nations."

May we not then rightly conclude that the pleasure we take in the cultivation of our gardens here, is adapted to prepare us for the enjoyment of that garden above.

It is here the physician should take his first lesson. Plant life is the first and simplest form of life. Having learned the operation of laws governing the simplest forms of vital action, he is better prepared to trace their operations with easy steps, up through the more complicated forms of life, till he reaches the highest form, human life, and thereby be better prepared to detect any organic or functional derangement, and the infusions and extracts of plants of the garden will furnish him the most valuable agents in restoring the diseased system to its normal condition.

The jurist may here learn the operations of law and the importance of complying with its requirements.

By the study of horticulture, the Theologian will be better prepared to discharge the duties of his high mission. He will here learn that as the earth turns to the sun to receive light, life and productiveness, so must the thought and affections of man turn to the Lord to receive the light and life giving influence of the sun of righteousness.

The lover of science may here find a wide field for investigation. The high and the low, the rich and the poor, may all find profitable instruction, and a rich reward for their labor.

Occupying a State unsurpassable in its adaptation to produce the greatest variety of the finest fruits, we may well be thankful that our lot is cast in a goodly land, unsurpassed in its capacity to support the greatest variety of pursuits; its inexhaustible supply of the most useful minerals; its rich agricultural as well as horticultural resources, affording facilities for the most useful manufactories, all in the centre of the largest circle of internal commerce on the Globe, with natural or artificial communication to every part. With such means of progress, who shall prophesy the destiny of an enlightened people in numbers, comfort, elevation and refinement.

Be ours the task to spread their pathway with fruits and flowers, and wine that maketh glad the heart. Since the organization of our society, notwithstanding one-third of the time our State has been desolated by war, great progress has been made in horticulture, adding to the comforts of our homes, and supplying the increased consumption of our towns and cities with improved fruits. Orchards and vineyards have been extensively planted with all the varieties of small fruits. Gardens are being better inclosed, and better modes of cultivation adopted; and landscape gardening is beginning to attract attention. Though much has been done, much yet remains to be done. We have stimulated extensive planting, and great improvements in cultivation. The people are becoming alive to progress. Everywhere they are inquiring for a more excellent way. Old prejudices are giving way to a desire for improved varieties of fruits and for better modes of cultivation. They are beginning to learn that every plant we cultivate grows in accordance with natural laws, and requires for its highest development certain conditions, and just so far as we supply those conditions artistically will be the measure of our success. Just so far then as we have practiced scientifically, and just so far as we have failed to do this we have failed both scientifically and practically.

Many erroneous theories have been put forth, and, consequently, been followed by failure. But science is a knowledge of the operations of natural laws, arranged according to their relations. But to give science its full value in practice, the hand must be taught by practice to obey the direction of the head in performing all the manipulations artistically and speedily. But while it is desirable to understand the operation of natural laws in the growth of plants, it is not essential to a large measure of success. A careful observation and comparison of results of different modes, when skillfully applied, will lead to scientific and successful practice, whether we understand the *rationale* of the operation or not. Every one, therefore, may by diligence and careful observation, become practically and scientifically successfully. "For they that are without law, but do the things contained in the law, have their reward."

We meet together to accelerate our progress and give the results of our experience, that each may get the benefit of the knowledge of all. With such facilities for acquiring knowledge, we ought to make rapid progress. The seed sown here annually ought to yield a yearly and increasing harvest. How many of us have come up with some thirty, some sixty, and some an hundred fold, according to our several capacities.

Although much progress has been made, we are but beginning to realize what we do *not* know, and to appreciate the importance of obtaining the knowledge we need. As yet we have no well established *best* method in any department of our work.

In the management of our orchards, some advocate high heads, and some low heads, some open heads, and some a central stem; some fall pruning, others spring pruning and summer pruning. In vineyard management, there is an equal, if not greater diversity of practice. So also with wine making, and all department of fruit culture.

Brethren, these things ought not to continue. Surely there is a best method of treating a particular kind of fruit in a given soil and locality. An important question to determine is, shall we devise methods of investigation adapted to settle these mooted questions? We have now colleges in which to teach the science of agriculture and horticulture; but as yet (properly speaking) we have no science of either. The sciences are yet in their infancy, and to be developed. They cannot be discovered within the walls of our colleges. The facts on which they must be based must be sought out among our plants in our fields and gardens. In the collection of facts every one can bear a part, and when collected, arranged and assimilated, they take organic form and make up the body of science. We may learn something of the mode of proceeding by observing the operation of natural laws in the development of plants. Different organs perform different offices. The roots take up the crude elements from the earth in definite proportions; these pass up into the leaves, where they combine with the elements from the air, and by the action of the light and heat of the sun become vitalized and fitted to form the living tissues of the plant.

So may we by careful observation during the season of our labors among our plants (where only they are to be found), collect the crude facts, pass them up to reflection, and by the light of reason and the love of truth they combine with other knowledge, and take organic forms as part of the body of a living science.

How many here will engage to co operate with committees, each in their favorite specialty, in collecting facts to report at our next meeting?

We are pleased to see the ladies with us; we regard them as an acquisition to every laudable enterprise, and we know of no pursuit more suitable to enlist their favor, than horticulture.

They are ever associated in our minds with fruits and flowers. Women, fruits and flowers are the comforts and ornaments of our homes; without them our homes wonld become rude and desolate. They are, therefore, entitled to and should receive our peculiar care.

In conclusion, fathers and mothers, let me say a word for the rising generation—our country's future hope. We have talked of fruits and flowers; these we cultivate and train with care; they bloom and give us pleasure a few days, and are gone; they are but emblems of flowers of immortal bloom.

These young saplings, that now come around our tables, are soon to become the pillars of the nation, and the fair flowers—our daughters—to become the mothers of a future generation. Shall we interest them in our labors, and see to it that they too receive the needed pruning and training, proportionate to their increased importance, and surrounded with the conditions most favorable for their proper development and future usefulness.

For, as we perform that duty, to a large extent, depends whether they shall in the future taint the air with poisoning breath, or shed a fragrance long on earth, and yield a sweet perfume in heaven.

The State Entomologist, Prof. C. V. Riley, read a partial report from the committee on Entomology, having a special reference to some insects affecting the grape vine.

The report in full will be found in this volume in his State report.

Dr. C. W. Spalding made some remarks on the subject of this louse, concurring with Mr. Riley's views. He had determined to exterminate his Clintons, and if that did not suffice he would destroy his Taylors. The loss would be small, compared with what evil would result from the propagation by these vines of the vicious insect.

Adjourned.

SECOND DAY.

The Society was called to order by the President, and the meeting opened by prayer by the Rev. F. L. Kenyon.

METEOROLOGICAL EFFECTS OF FORESTS.—BY J. H. TICE.

Mr. President, Ladies and Gentlemen:

My object is to discuss a subject which has had, and ever will have, an important bearing on human well-being; which in the past has rendered Man a fugitive and a vagabond on the face of the earth, and which, in the future, will continue to scourge him, until experience and reason will bring him in harmony with Nature.

This subject is the great law which holds a climatic correlation between moisture and the earth's verdure, and between aridity and its nakedness. The ignorance of this law, or of its non-observance, has, in the past, inflicted an untold amount of misery upon man; and upon its knowledge and observance will depend his future prosperity and happiness. If this can be shown, then, if woe betide him hereafter, he must acknowledge it as a just punishment for his delinquency; and if weal, he will have the consciousness and satisfaction of knowing that it is a reward for his faithfulness and obedience.

As it is impossible to fix man's advent upon the earth, so it were futile to attempt it. All we do know is, that he appeared in the tertiary period, and was cotemporaneous with the primitive horse and mastodon; because stone implements have been found with figures of both engraved upon them. But how long ago that has been—whether ten thousand or ten hundred thousand years, no one can tell or ever will know.

In the time when Northern Europe was yet submerged—when the reindeer roamed over the Alps—man was there, dwelling in caves, and his bones lie mingled with those of the primitive horse, of the reindeer, the mastodon and bosbifrons, making it probable that these animals served him for food.

But in the progress of time, either from increase in intelligence, or of numbers, he forsook the caves and built for himself dwellings consisting of four large stones for the sides, and one for a cover. This is called, in archaeology the megalithic, that is the big stone age. These houses, buried in the soil, are found from the British Isle to farthest India, and south to the Cape of Good Hope. Evidently these structures were co-extensive with the human race at that period.

In the megalithic age, man became, if he was not before, a terraculturist, for petrified heads of wheat, rye and barley are found buried with these houses in swampy places. Hence it is probable, at this period commences the date of his reactionary agency upon climate. To raise the cereals and to find pasture for his flocks, he had to clear away the primitive forests; and it was impossible for him to have denuded large areas of land without observing the consequent climatic changes.

No facts exist to furnish us with the least clue for measuring the length of the duration of this age, but probably it extended over thousands of years. Be its length what it may, the whole of it was a pupilage of the primitive man in the school of experience, teaching him many lessons that he will never forget. Amongst these lessons unquestionably was this, that the destruction of forests smote the climate with aridity, and consequently the earth with sterility. As he could not penetrate to the cause of this, his unsophisticated mind attributed these changes to the wrath of the gods. But why to the wrath of the gods? What had offended them? While the primitive forests remainded the gods were propitious; the rains descended copiously, springs welled up, and the rivers flowed. The earth also was clothed with verdure and teemed with bountiful harvests; the forests were filled with game, and the waters with fish. But when the forests were gone the rains ceased, the fountains and rivers dried up; the earth was parched and became an inhospitable desert, the tenants of the wood perished or fled, and the fish disappeared with the streams, Surely if calamities so great were not evidences that the gods were offended, what could be received as such? But what was the cause of the offense?

What so lovely as the grove, and what so transcendently beautiful as the forest, under whose shady canopy is collected everything that is pleasant to the eye or grateful to the senses? There the waters gush up to the sun, sparkle in the light, and murmur as they run. There nature's orchestra is never silent, but music mingling in symphonious harmony from high alto to deep bass forever floats in the air. There gaudy insects disport themselves in the sunbeam; and there the shepherd seeks shelter from the heats of summer and colds of winter and repose for himself and his flocks. There roam the graceful deer and fleet antelope in freedom, and also the fierce leopard, the panther, the tiger and the lion. Surely, if the gods dwell anywhere upon earth, or even have a temporary sojourn here, it must be in the groves and the forests. So reasoned the primitive man. Hence not only his inference that war upon the forests was war upon the gods, but also if man wished to draw near to the gods and hold communion with them, he had to go to the groves, their dwelling place, and there pay his adorations and prefer his supplications. So evidently was this the process of his reasoning that its impress is indelibly stamped on all the ancient religions. Druid, Roman, Greek, Heathen and Hebrew, however widely different were the gods they adored, they had one thing in common in which they all were in accord, that of worshipping God in the groves. Abraham planted a grove in Mamre, and there called upon God. Moses and Joshua, feeling that this their universal sentiment would lead the Israelites back again to idolatry, enjoined upon them to hew down and burn the groves of Palestine, for there, they say, the Canaanites worshipped false gods. Too faithfully did the Israelites carry out this injunction, and Palestine, instead of a land flowing with milk and honey, has become treeless, herbless and almost a desert. The early, that is the winter rain, yet comes in its season, but the latter, the spring rain, no longer visits the naked plains.

The ancient legends and myths of Greece and of Rome, had we no historical evidence of it, show not only that worshipping in the groves was universal, but also the reason for it. It is a historical fact, that the ancient Pelasgic oracle of Dodona was situated in a sacred grove. So also the Greek oracle at Delphi. But what is remarkable in this latter case, is, that the cave whence issued the prophetic vapors that inspired the Phythia, was situated in a sacred grove where the responses of the oracle alone were delivered. In that magnificent poem, "The Forest Hymn," Bryant, the greatest of American poets, has beautifully described this universal custom of the ancients:

"The groves were God's first temples, ere man learned
To hew the shaft and lay the architrave,
And spread the roof above them; ere he framed
The lofty vault to gather and roll-back
The sound of anthems, in the darkling wood
Amidst the cool and silence, he knelt down
And offered to the Mightiest solemn thanks
And supplications."

The religious sentiment that the groves were the natural temples of the gods necessarily carried with it the corollary that they were sacred, and consequently the act of destroying them sacriligious. Hence, Virgil relates how Eneas, to build his fleet with which to flee from Troy to Italy, being obliged to obtain timber from the groves of Mount Ida, durst not do it until he had obtained permission from Cybele, to whom they were dedicated. In fact, the ancient priesthood, which represented almost exclusively the intelligence of the primitive world to preserve the groves and forests, dedicated them to some deity, and inculcated the dogma that he who destroyed them was guilty of sacrilege, and would be punished by the offended God. A few myths and legends will suffice to make this evident, and also the reason for inculcating it.

According to an ancient myth, Erisichton derided Ceres and cut down her groves. This impiety so irritated the goddess, that she afflicted him with continual hunger. He sacrificed all his possessions to satisfy the cravings of his appetite, and finally devoured himself for want of food. According to the ancients, not only the groves were sacred, but each tree had a nymph called Hamadryad, that cared for and protected it. Moreover, that the fate of these nymphs had a dependence on their trees, and that they lived and died together. Apollonius relates a beautiful legend illustrating this point and incidentally the belief that trees and moisture are concomitants. He says, Rhaecus, observing an old oak ready to fall, ordered his servants to set it upright again, and put fresh earth and manure around its roots. The Hamadryad, who must necessarily have perished with the tree, grateful for what he had done, appeared to him to thank him, offering at the same time to grant any favor he might ask. He replied the act was one of piety, and the consciousness of having performed his duty, was ample reward to him. She then promised to bless him with continued prosperity, that his fields should teem with abundant harvests, and his flock increase a hundred fold; which accordingly came to pass. But in the lapse of time a severe adverse calamity befel him. Thinking that the Hamadryad had violated her promise, to avenge himself he cut down the oak. Immediately he was paralyzed and rendered helpless, his fountains no longer sent forth water, his streams dried up, his lands parched by drought, were sterile, and he finally perished with hunger.

This must suffice as evidence that in the earlier ages, ere history or even tradition was born, man had learned an important lesson, which if he had reduced to practice, the aspect of the globe and the distribution of mankind would have been far different than what they now are. The waters of the Dead Sea would still flow into the Gulf of Suez; the river whose dry bed was traced by Belzoni through the centre of the Great Sahara, and which is called by the Arabs, "the river without any water," would still bring its tribute to the Mediterranean. The plains of Assyria and Babylon would still be the seats of opulence, population and power; Sahari, Gobi, and other deserts would find neither name or location on our maps; and Spain, Palestine, Egypt and other arid and sterile regions would still be the granaries of the world.

There has been received certain sayings, as though they embodied unquestionable historical truths, for instance, "the children of Adam follow the Sun," and that "Westward the Star of Empire takes its way." Some have gone so far as to suppose that innate instinct determined this assumed course in man. Like many other dogmas, accepted as true without investigation, these sayings will not stand the ordeal of close scrutiny. The migrations of the Toltects and Aztecs, on our own continent, have been from North to South, while those of the Egyptians have been the reverse, from South to North. It is only true of the Asiatics and Europeans that they emigrate from East to West. Philosophically, therefore, no innate law of humanity is even supposable as presiding over, and directing these migrations.

The direction of human migrations is not determined by an inherent law; for, if it were, it would be as irreversible as solar and planetary motion. It receives its entire impulse from a necessity imposed by man's own agency. The edge of a forest being set on fire, the con suming element travels necessarily in the direction not yet wasted by it. Sò it is with man. He is a waster of forests, and hence in his migrations he follows the receding forests, whether they lie North, East, South or West.

While man remained a savage and lived by the chase, forests not only supplied his simple wants but also afforded him shelter alike against the scorching heats of summer and chilling blasts of winter. But when he emerged from the savage state and became a terra-culturist, trees had to give place to the cereals, grasses, etc. From that day the forests receded and disappeared before the advance of man, and the degredation of climate commenced. Why? Because, not knowing the great law of compensation, that forests hold climate in a medium equipose between opposite extremes, he destroyed them and brought on aridity and sterility. Practically his advance was like that of fire through a forest, exuberant fertility in front, and desolation in the rear.

If we examine the legends of ancient migrations, or the facts that authentic history furnishes of such, this is the only explanation that accounts for both, presenting them logically in the category of cause and effect. Let us see. Erosions on the cliffs, high above the waters of Salt Lake as at present, show that the lake formerly must have been deeper, covered a larger area, and consequently must have received more water than now. Fossilized wood found all over the now treeless and almost herbless plains of the Great Basin, show that formerly it must have been a well timbered country. Indications are also abundant that it was once densely populated by a primitive race. South, on the San Juan River, immense ruins of ancient cities have recently been discovered; and further south on the Rio Colorado Chiquito west of Zuni, are the well known ruins of the seven cities of Cibola. All the region drained by the Colorado is covered by the ruins of ancient cities, and must have been densely populated, and therefore must not have been, as now, a treeless, arid desert. Great climatic changes must, therefore, have taken place to have converted this once populous region into an inhospitable desert. What causes were in operation to produce this effect? The legends of both the Toltecs and Aztecs of the valley of Mexico point to the Great Basin, and the plains of the Colorado as the ancient abode of their ancestors, and whence they emigrated to Mexico. We are justified in the inference that necessity compelled their migration; and that they fled from the desert, a curse they had brought upon the land and themselves. This inference gains strength when we look into the civil policy of those nations relating to forests, whence we infer that they had learned a severe lesson by experience, namely, the cause that necessitated their migration. Prescott, in his history of the conquest of Mexico, informs us that both the Tescucans and the Aztecs had severe laws against the wasting of forests. No one was permitted to gather wood except what was fallen down, nor to cut timber without leave from foresters appointed by the King.

Historically, we know that Egyptian migration was down the Valley of the Nile, that is from south to north. Egypt's first capital was Meroe in Nubia. Herodotus informs us that all the ancient traditions agree that at that time the Valley of the Nile was covered with dense forests and extensive marshes. Within the present century the truth of these traditions has been established by French savans, who exhumed at all points petrified trees and stumps. No other explanation is possible, except by the hypothesis that they grew where they are found buried, and that the entire valley was once covered with dense forests. Belzoni, in 1817, found the bed of an ancient river far out in the desert, near the oasis where once stood the famous temple of Jupiter Ammon. The Arabs called it "the river without any water." Belzoni, in tracing its bed, found what was once an island covered with immense petrified stumps. Some distance from Cairo, but out in the desert, is now to be seen a petrified forest. These and other evidences show that Egypt, and at least a great part of the Sahara, were once covered with forests. Now, since a search of the entire surface of the earth will not reveal such an anomaly as trees without rain, therefore the inference is irresistible that Egypt and the Great Sahara were not formerly as now, rainless. As the trees have disappeared by human agency, man is responsible for the climatic changes effected. Egyptian cultivation in ancient times, we know, extended far into regions now covered with the sands of the desert. The cause of the degradation of the climate, it is now admitted by the Egyptians themselves, was that before the march of man down the valley of the Nile, the primeval forests disappeared until not even a representative tree was left.

It is most true, that in Egypt civilization came down the valley of the Nile, but it is not the whole truth. Civilization in the past, like many other benefits, has not been an unmixed blessing. Egyptian civilization, like the Eastern civilization in Asia and Europe, and like the Toltec and Aztec civilization in our own continent, left desolation in its rear.

The successive removals of the Capitals of ancient Egypt, first at Meroe, next at Thebes, and finally at Memphis, were necessitated by the utter desolation caused by the encroachments of the deserts that successively overtook them. So overwhelming and complete was the triumph of desolation, that the very sites of these capitals become mooted questions; and the exact localities of Meroe and Memphis, (both in the desert,) have only been determined by researches made within the present century.

The most ancient traditions and Scripture place man's origin in Eastern Asia, where he was surrounded by an exuberant vegetation, and consequently where the animal kingdom abounded in immense numbers, and in innumerable forms. How long he lived upon the fruits of trees, upon fish, the chase, and other bounties of nature, and how widely he became dispersed before necessity forced terra culture upon him, it were futile to inquire as neither tradition nor history inform us. Moses informs us, that after the transgression, man was sent forth to till the ground; and also that a cherubim with a flaming sword was placed East, which turned every way to guard the tree of life. The sending him forth from the Garden of Eden to till the ground, may dimly shadow forth the great change in his physical condition when he ceased to be a beneficiary on nature's bounty, and was doomed in the sweat of his face to eat his bread all the days of his life. The flaming sword also may symbolize the scorching desert he had placed between himself and his lost Eden, since Hagi Ismael describes a desert "as a place where the earth is on fire, and the wind a flame." Be this as it may, he turned his face to the primitive forests of the West, which disappeared at his approach, and desolation followed in his rear. The present arid desolate condition of Persia, Afghanistan, Beloochistan, Mesopotamia, Syria, etc., countries famous in history for their fertility, population, power, wealth, science and refinement, show that great climatic changes have taken place. Now these changes must either have been wrought by human agency, or by astronomical causes. If by the latter, then it must have been by a physical change in the constitution of the Sun; as he is the great vivifier not only of the Earth but of the Universe. He not only sets in motion the mainsprings of plant and animal life, but with irresistible power and majestic grandeur he hurls our globe and planets with inconceivable velocity around him through space. Whatever of motion there is on the earth, in the ocean, the air or in the solar system, emanates from the energy of the sun. We know planetary motions are not only uniform but invariable, not having changed or deviated even a fractional part of a second since the days of Hipparchus the first observer, two thousand two thousand years ago. Hence the energy producing them must be constant, uniform and invariable also. The annual mean of all physical phenomena, hygometric, meteorologic, electric, magnetic, thermal, etc., are also physical constants. It were therefore futile to look for the cause of climatic changes within the historical period, to astronomical changes. Our only alternative then is to refer them to human agency. Especially are we justified in so doing when all admit that the natural operation of known physical laws is such as to work these changes under proper conditions; and that the operations of man can and do produce those conditions. Let us see how this is.

About three-tenths of the earth's surface is land, the remaining seven-tenths being water. As the average annual energy of the sun is a physical constant, so the annual average of water vaporized from the ocean, and consequently the annual average of rain precipitated must be physical constants also. Neither the area nor the physical condition of the water surface of the earth has changed within the memory of man. Hence, neither has the reaction of the ocean upon the atmosphere changed within that time. Then, consequently, as far as rainfalls on the ocean are concerned, other things being equal, the amount of rain on the water surface must not have changed either. But how is it with the land surface of the earth? In Europe, Asia, and Africa, where thousands of years ago were impenetrable forests, there are now treeless and desolated plains. The condition of the land surface of the earth being different now than formerly, its reaction upon the atmosphere must also be different. In respect to rain and drought, this reaction is as follows: Rain only falls from an atmosphere that is cooling after taking up and holding vapor in suspension at a higher temperature. Volumes of air nearly filled to saturation with vapor, are constantly drifting over surfaces of lower as well as higher temperature. Those drifting over surfaces of lower temperature become cooled, clouds form over, and rain falls on such cool surfaces. Now, which are the cooler: surfaces clothed with vegetation, especially with trees, or barren, naked plains? Even dumb animals know, for they fly from the scorching rays of the sun in the open fields, to the grateful cooling shades of the forest. While, therefore, the great physical law remains in force, that rain can only fall from a cooling atmosphere, and as long as it is a physical fact that the shade is cooler than the sunshine, so long must the amount of rain fall on timbered countries be greater than that on naked plains.

Precipitation depends on saturation, and saturation upon temperature. Generally, while the temperature of the air is rising, saturation cannot take place; but when it is falling, the point of saturation is reached at some time, and rain begins to fall and continues to fall as long as the temperature descends. Careful experiments show that air at the temperature of 32 degrees Fahrenheit when saturated holds 1-160 part of its volume of aqueous vapor in suspension. At 59 deg. it is saturated by 1-80 part of its volume; and at 86 deg., by 1-40 part of its volume of vapor. Hence, every time the temperature of the air is raised 27 deg. Fahrenheit, its capacity to absorb and hold vapor in suspension, is doubted. Therefore, air saturated at 89 deg. holds in suspension four times the quantity of water as when saturated at 32 deg.

We have seen that forests are cooler during the heats of summer than open fields or naked plains; consequently there must be a difference in the temperature of their respective superincumbent atmospheres. If the vapor be equally distributed in their respective atmospheres, then that over the forest is nearer the point of saturation than that over the adjacent plains; and when that over the forest is saturated, that over the adjacent plain is not so by the ratio of the difference between their respective temperatures. But during the day the sun's rays increase this difference, movements of air set in, and the general temperature of the whole atmosphere is raised. Thus still greater quantities of vapor are taken up and held in suspension. This process may go on for days and weeks and even months, until saturation at a high temperature is attained—then a reaction sets in, perhaps by the intervention of a colder stratum of air, or by drifting over a cooler surface, or which is more probable, by some change in the higher regions of the atmosphere by which the transmutation of heat into electricity is facilitated. Whatever may be the approximate cause, the reaction is violent in proportion as the phenomenen was abnormal by which saturation was attained. Tornadoes, hail storms, water spouts, and deluging rains are the natural and inevitable consequences of such abnormal conditions. As might be expected these hydrometeors mainly appear, and develop their most destructive forms in the vicinity where large areas of land have been denuded of vegatation and exposed to the direct influence of the sun. The pleasant, cool, bracing and often chilling weather, that follow these violent commotions, show that they were brought about by some cooling process in the atmosphere.

As the main physical law of meteorology concerned in the production of rain must now be sufficiently clear to comprehend and explain the facts produced by its operation in various parts of the world within the historic period, so we can now proceed to show what has been and ever must be the effect of deforestation. These effects may be treated under three different heads: first, amelioration of climate where the forest is too dense; second, degradation, where deforestation is carried beyond due limits; and third, permanent aridity and sterility where the destruction is total. First then examples of amelioration.

It cannot be controverted that the climate of northern and central Europe has been greatly ameliorated within the last two thousand years. Varro speaks of the climate of southern France as unfavorable to the growth of the vine and the olive. Virgil describes the Crimea as subject to the rigors of an eight months' winter. Diodorus Sicelus narrates how whole armies crossed the frozen Rhine, Rhone and Danube. In fact, all ancient authors are agreed as to the rigors of the climate of central Europe at their time.

America affords a similar example of amelioration. The early settlers of New England and Virginia speak of this severity, length, but equability of American winters, which is irreconcilable with their comparative mildness, shortness, but extreme variability now. Jefferson, in his notes on Virginia, records this testimony of the old settlers, which he says is corroborated by his own observation and experience. He says within the recollection of the living generation the climate has been much modified. The snows are fewer and less in quantity, and remain a shorter time on the ground. Streams that were formerly closed for weeks with ice, now seldom freeze over. The changes from warm to cold and *vice versa* are now more sudden, frequent and extreme. "When spring then came it came to stay, and not as now relapse suddenly back into winter." Jefferson gave it as his opinion that these changes have been caused by clearing away the forests exposing the soil to the warming influences of the sun, and by giving freer passage to air currents, whether warm or cold. In Europe the amelioration of climate is attributed to the same cause; and there can be no question as to the correctness of the inference.

Who has not observed that the snows and ice of winter lie longer in the forests than in the open fields? Europe 2,000 years ago, and America when discovered were covered with an almost unbroken wilderness of forest. The ice and snow then melted not so soon, and consequently the winters were longer than now. Deforestation whenever carried on within due limits has been a benefit, shortening the winters and producing a general amelioration of climate.

Let us now give a few instances of degradation of climate. The stringent forest regulations of the Tescucaus and Aztecs have already been mentioned. The effects of these regulations and their abrogation by the conquerors are thus described by Prescott, the historian:

"In the time of the Aztecs, the land was thickly covered with larch, oak, cypress, and other forest trees, the extraordinary dimensions of some of which remaining to the present day, show that the curse of barrenness in later times is chargeable more on man than on Nature." And again, "The soil once carpeted with a beautiful verdure, and thickly sprinkled with stately trees, is now bare, arid and parched, and in many places white with the incrustations of salt caused by the diminution of rainfall, and the evaporation of the waters consequent upon the denudation of the country."

Wm. C. Bryant speaking of the effects of deforestation in Eastern Ohio, says:

"It is a common observation that our summers are becoming drier and our streams smaller. Take the Cuyahoga as an illustration. Fifty years ago, large barges loaded with goods went up and down the river; and one of the vessels engaged in the battle of Lake Erie was built at Old Portage, six miles north of Albion, and floated down to the lake; now in an ordinary stage of water, a canoe or skiff can hardly pass down the stream. Many boats of 50 tons burden were built on the Tuscarawas and loaded at New Portage and sailed to New Orleans without breaking bulk; now the river hardly furnishes a supply of water at New Portage for the canal. The same may be said of other streams; they are drying up and from the same cause, the destruction of our forests; our summers are becoming drier and our winters colder."

The former rank and tall grasses on the primitive prairies, measureably answered the purposes of forests. The summer rains certainly were then more equable and abundant than now. Streams that forty or fifty years ago furnished milling power the whole year round, are now dry except in time of freshets. The steady decrease of water in our western rivers, even in the great Mississippi, warns us of deleterious influences at work and of impending danger. Our steamboatmen recollect the time when steamboats that now cannot, in low water, ascend higher than Memphis, could without difficulty at all seasons of the year ascend to St. Louis. Destruction of the forests at the sources of the rivers tributary to the Mississippi, and wasting prairies along the affluents of these rivers, are the causes of this deterioration. The unshorn natural meadows, the prairies, are practically amongst the things of the past. The rank, tall grasses whose wave-like motion showed every pulsation of the wind, are no more. Denuded by our flocks, and the native grasses exterminated, there only remains the naked plain. Now, a naked, parched plain is a very different thing from one clothed with the vesture of the primitive prairies. Its reaction upon the atmosphere, and consequently meteorological effects are entirely different. One favors the condensation of vapor and the precipitation of rain, the other favors the dispersion of both. Hence we find with the disappearance of the verdure of the primitive prairies, aridity of climate sets in and the streams dry up. The following fact illustrates this. Near Quincy, Illinois, are several streams that forty and fifty years ago supplied ample water for milling purposes. One of these still bears the name of Mill Creek. Were it not for the old dams and dilapidated mills, the tradition that they afforded water power for mills might be regarded as fabulous; for now all the creeks afford but little running water at any season, and during the whole summer and autumn are perfectly dry.

In all respects the phenomena of gradual falling of summer rains, aridity of climate and drying up fountains, are similar on prairies as in the forests. On the Atlantic slope, there is scarcely a mill owner who is not aware that as the country is cleared up, the springs fail, and the streams gradually dry up. A new phenomena however appears. The rains of summer, though fewer are more deluging, and destructive freshets, formerly unknown, become common.

As already stated, all our rivers are suffering from a diminution of water, and indications are thickening of impending calamities still greater. We are trying to deceive ourselves with the delusion that our rivers are becoming shallower, because cultivation has facilitated their encroachments on the soil, and that they are only widening their channels. Now this is not the case; and no one can point to a solitary instance that justifies such a hypothesis. In Germany, observations have been made by actual measurements on the river Elbe, for the last eighty years. The width of the channel has been accurately measured, and the volume of water calculated. In that time the width of the channel has remained the same, but its depth has decreased nine inches, and the volume of water discharged is eighteen per cent. less now. The records of the observations and measurements show that the decrease was gradual and uniform for every decade. What was the cause of this? In the last eighty years millions of cords of wood and billions of feet of lumber have been cut from the forests and mountains along its sources.

Facts could be quoted indefinitely to prove that islands as well as continents suffer the same deplorable consequences, long drouths, alternating with deluging rains, waterspouts, hail and tornadoes. Trinidad, Martinique, Cuba, San Domingo, in fact the whole West Indies and Cape Verde Islands, as well as Spain, Italy, Greece, etc., would afford examples to this effect, but we must forbear.

There is, however, another class of facts which cannot be omitted without impairing the force of the argument and its application. These facts show that a climate, however much degraded, can be restored.

In the rear of the city of Caraccas, on an elevated plain, the *Theobroma cacao*, from which chocolate is made, formerly found its most congenial climate, both as to heat and moisture. But to extend the plantations the whole plain was denuded of its forests. The result was, the rains ceased, and the climate became so arid that the cultivation had to be abandoned. But nature quickly restored the vesture of the abandoned plain, and the cultivation of the cacao has been resumed. Farther in the interior and higher up on the mountains, is the valley of Aragua. Having no outlet to the sea, its waters collect in a central plain and form Lake Fariqua. In 1855 the Spaniards founded New Valencia, one and a half miles from the lake. In 1800, when Humboldt visited the city, it was three and a half miles from the lake. In 1740, a fortress was built upon an island (Cabiera) in the lake. When Humboldt was there Cabiera had become a peninsula. He also found new islands appearing in the lake, and many hillocks on the shore called islands, from once having been surrounded by water. Humboldt attributed this diminution of the waters to the extensive clearings made in the valley. The elevation of the valley and its immense fertility had adapted its soil and climate to the production of the cereals and fruits of Europe. Consequently it had become almost as densely populated as the valley of the Rhine. When the revolution broke out the peaceful valley of the Aragua became the theatre of many bloody conflicts. At the first cry of Independence, both master and slave (the latter being freed) enlisted under the banners of the Republic. Again and again its population was decimated, until extermination was accomplished. Plantations being abandoned, the recuperative energies of nature in that tropical clime soon restored the forests. Boussingault, who afterwards visited the valley, in his *Economie Rurale* says:

"Twenty-two years later I explored this valley. For many years previous the inhabitants had discovered that the waters of the lake were no longer retiring, but on the contrary were rising. Grounds not long before occupied as plantations were submerged. The island of Nuevas Aparecidas, which appeared above the surface in 1776, was again covered with water; and Cabiera had again become an island."

Clave, in his "Studies upon Forest Economies," says: "St. Helena, stripped of its ancient forests had become almost infertile from the failure of rains. Within the last thirty years the wooded surface of the island has been considerably extended by replanting, and the rain has increased in proportion. The quantity now falling is fully double what it was during the imprisonment there of Napoleon."

Wolf Spring, in the commune of Souby, ninety years ago had no existence. Only after long rains water temporarily oozed from the soil where the spring afterwards appeared. The spot is in the middle of a steep pasture. About that time the owner perceived young firs springing up on the heights, which, under protection soon become a dense grove. When the trees were fully grown, a fine spring appeared in the place of the temporary ooze, furnishing an abundant supply of water, even during the longest drouth for fifty years. Twenty years ago the grove was felled, and to-day the spring is as dry as it was ninety years ago.

Mehemet Ali, the Viceroy of Egypt, fifty years ago planted some forty or fifty millions of trees in Egypt to increase the rains. During the time the French, under Napoleon, occupied Egypt (which was sixteen months), not a drop of rain fell there. Since the trees planted by the Viceroy have become grown, the annual average of rainy days is thirty.

Since the Mormons have settled in Utah, and planted considerable trees, the waters of Salt Lake have risen seven feet. A correspondent in Utah, of the Agricultural Department, in June last writes as follows:

"We must irrigate in most localities, but it has been demonstrated that by planting trees and cultivating the soil, the rainfall increases every year, requiring constantly less irrigation. As we have not got the water in all parts of the Territory, we resort to tree planting in the hope that it will remedy the evil.

The English destroyed the forests of the Decan, once of equable climate and exuberant fertility, until it now has become arid and sterile. For several years the East India Company have been replanting large districts with forests, in hopes of restoring its former climate.

In Queensland, Australia, aridity has so much increased by the indiscriminate destruction of the forests, that the Australian government has taken the care of the forests in charge, and is annually replanting the denuded districts. If anything further were necessary to prove the deleterious effects of denuding the earth of vegetation, we might quote the highest scientific authorities, who, from facts that have fallen under their observation, have given it as their unqualified opinion that deforestation cannot be carried on anywhere without degradation of climate following as an inevitable consequence. These are the well-known opinions as expressed in their work on physical science, of Humboldt, Herschel, Boussingalt, Marsh and others. But we prefer to let facts speak; they are of higher than human authority.

We must now close the argument on this part of the subject, and proceed to discuss another and perhaps the controlling law of Meteorology, namely, that of electric action. Electricity is of two kinds; the positive and negative; or as it has been more pointedly yet typically expressed in the Zend Avesta, the sacred book of the Parsees: "There are two principles in Nature; the male and female. In consequence of being of opposite sexes, they are perpetually seeking each other." Positive electricity (the male) fills interstellar space and penetrates somewhat into the upper regions of our amosphere. Negative electricity (the female) surrounds and fills the Earth and all matter and bodies in space. Now if an insulated conductor be charged with either positive or negative electricity, and brought in the vicinity of another but uncharged conductor, by induction it separates the insensible electricity of the latter; attracting the dissimilar to the nearer side, and repelling the similar electricity to the farther side. Electric attraction, therefore, only subsists between the opposite electricities. If a conductor is corrugated, the ridges will show greater electric tension than the furrows; in fact, the latter may be devoid of any sensible electric excitement. The earth is a corrugated conductor; hence the negative electricity with which it is charged mounts to the highest points, and therefore mountains are more highly charged than plains. The positive stoops down to meet the negative, but is prevented by the intervention of the atmosphere, a non-conductor. Their meeting is therefore only possible by the happening of either of two contingencies—first, when the mutual attraction is so great as to cause a disruption of the intervening non-conductor, then thunder and lightning take place; or, secondly, when the positive seizes upon some matter floating in the atmosphere, as vapor or clouds, which gives it transportation to its mate, the mutual attraction giving the motion. This is the reason why clouds dash themselves with such headlong fury against mountains. It also shows why mountains are the recipients of greater quantities of rain than plains.

In the West, it is a well-known fact that rains gather over and follow belts of timber. Why? Because the trees are higher than the adjacent plains, and electricity everywhere mounts the highest points. Consequently by the same law that operates in mountains, the areas covered by trees must receive larger quantities of rain than naked plains.

The law of electric distribution is, that it is evenly distributed over equal areas of surface. Now everything on the surface of the earth, as a house, tree, stem, branch or leaf, adds its superfices to that of the Earth, and receives its equal part in an electric distribution.

Hence an area of timber land, by its trees and their foliage, may have its area of surface increased five thousand fold over an equal area of plains. Consequently its electric potentiality will be increased in the same proportion. Hence, its electric reaction upon the atmosphere will be in the same proportion, and will attract to itself more copious and abundant rains.

The great lesson inculcated by these facts for man's benefit, is, that he is endowed with power to become an ameliorating agent of the earth; that he, within limits, can control the elements, and make them ministers of his welfare and happiness, by modifying climate where too rigorous, and repair the waste places of the earth. To do this, he has only to plant trees where they have been destroyed or are absent. He will then realize the truth of Mahomet's benediction: "Blessed is the man that planteth a tree;" and the philosophy of the remarkable aphorism of Zoroaster in the Zend Avesta: "He that planteth a tree watereth the earth, which is a more acceptable service to God than prayer and praise, or burnt offering and sacrifice."

The planting of trees will not only temper the heats of summer and the rigors of the cold of winter, but it will effect a condensation of vapor and facilitate the precipitation of rain. Moreover it will effect an accumulation of electricity; and wherever there is an accumulation of electricity, there is a favorable condition for a wedding between the son of Cœlus and the daughter of Terra. The bride, to meet her spouse in the airs, mounts the highest trees or ascends the highest mountains; but he can only meet her by water. Hence he makes the clouds his chariot and brings to the nuptials a shower, a gift so grateful to Ceres and Pomona. The earth rejoices at the marriage and teems with bountiful harvests and luscious fruits.

The great lesson is now before us. Will we repair the injuries the thoughtlessness and reckless of man has inflicted upon the earth, and its climate; will we go forth and ameliorate the rigors of climate on our Great Western Plains; yea, more, will we make the Great Sahara again blossom like a rose, and a congenial habitation for man? Or will we make of ourselves, as man has made of himself throughout the past, a fugitive and a vagabond on the face of the earth, ever fleeing from, but never entirely escaping the curse wherewith his stupidity has smitten the earth. With us and ours is the responsibility, whether all the waste places of the earth shall be reclaimed, or whether greater calamities now impending shall come upon us, fulfilling the vaticinations in the soliloquy of Bryant's Indian, revisiting in the East, the burial place of his fathers:

"But I behold a fearful sign,
  To which the white men's eyes are blind,
Their race may vanish hence, like mine,
  And leave no trace behind,
Save ruins o'er the regions spread,
And the white stones above their dead.

Before these fields were shorn and tilled,
  Full to the brims our rivers flowed;
The melody of waters filled
  The fresh and boundless woods;
And torrents dashed and rivulets played,
And fountains spouted in the shade.

Those grateful sounds are heard no more,
  The springs are silent in the sun;
The rivers by the blackened shore,
  With lessing currents run;
The realms our tribes are crushed to get,
May be a barren desert yet.

Dr. Spalding, in a few remarks, stated that the latitudes were changing; fixed points were proved during observations of centuries, to be moving towards the equator. Dr. S. asked Mr. Tice if this fact might not form partly the cause of the climate change referred to in his essay.

Mr. Tice responded that it might be so; but the effect was so infinitesimally slight as to be practically imperceptible. It had been indisputably proven that the upheaval of mountains on opposite sides of the earth was cotemporaneous. This being so, the climatic changes in Europe might be in some degree resultant from this cause: electricity is the great warning element of the universe. He did not believe in the theory that the centre of the earth was a molten mass.

Dr. Spalding spoke further on the theme. He did not regard the theory of the forest-cutting as sufficient to produce the changes of climate in Europe.

Mr. Park asked Mr. Tice for his views upon the question of checking the cold blasts of the North in their course South, and for means of preserving our orchards from the effects.

Mr. Tice suggested that the planting of long belts of evergreens was the only practical means he could suggest. In the course of his remarks, he gave the result of an experiment. On a very cold day, he took an observation on the windward and leeward sides of a grove. The thermometer marked six degrees greater depression on the windward side.

Mr. H. M. Vories believed that as much rain fell now as formerly and doubted whether the theory of denuding the land of trees was the true cause of the lack of rain. The cutting of trees was, also, necessary to agriculture; and if science could not help us to more rain, without restricting agriculture, it would not accomplish the desired result.

Mr. Tice adduced well established facts, proving the position assumed in his essay. He did not know whether the observations of rainfalls at St. Joseph was directed to the subject so as to be valuable in considering the matter. He was aware, however, that the ordinary observations did not throw the necessary light on the subject.

It was desired to know, not whether the same amount of rain fell, as whether the fall was normal and fairly distributed throughout the season. No such observation had been made.

Mr. Murtfeldt suggested that the meteorologic effects of forests was well established, and acknowledged by scientific societies. The Illinois Horticultural Society had offered premiums for forest planting. The Pacific Railroad Company had an officer appointed to superintend the planting of seeds to produce forests, and the effect of the mere laying of the rails for this great thoroughfare had been already shown.

Mr. Vories said our last Legislature passed an act offering premiums for the planting of trees in prairie districts.

The President announced the following committees:

On Young Wines.—Dr. C. W. Spalding, Rev. Chas. Peabody, Dr. B. L. Stephens and S. F. Taft.

On Old Wines.—T. W. Guy, J. H. Tice, C. H. Mansur, C. V. Riley, Thos. R. Allen, D. Carpenter and Col. G. H. Koch.

On Fruit on Exhibition.—Wm. Stark, L. D. Munger and Jacob Madinger.

On Flowers.—J. H. Tice, A. H. Vories, G. S. Park and Mr. Riechard.

The report of the Secretary was then read.

SECRETARY'S REPORT.

The past season has been quite disastrous to the fruit growers in our State. The crop of apples, peaches and some other fruits having been destroyed by the late spring frost. Grapes alone have been a success. Complaints are more numerous this season and more widely spread than formerly in regard to the ravages of insects, and special attention should be directed to secure the very closest attention of all interested, so as to secure that co-operation which alone can be efficient. In this movement, above all others, isolated action can never be effective.

Of all the ills that bear on the cultivators of the soil, those that spring directly or indirectly from insect actions are the greatest. This point is so directly practical and so important that its constant *re*-presentation will be pardoned.

During the past two seasons we have tried a number of experiments with a view to determine if there are any ingredients that can be brought to our aid.

The application of carbolic acid to the destruction of insect life in its varied forms, has far exceeded in ease, certainty and promptitude of action anything we have ever tried.

It is cheap of itself. The first quantities used cost eighty cents an ounce, being pure crystals, it can now be purchased in a crude form though but little less effective at fifty cents per pound. It combines freely with water, and unites in oleaginous compounds in any desired proportions. In combination with dry substances as earth, clay, or "fuller's earth," it is singularly simple and effective. In the dry form it is one of the most effective vermifuges we have met.

We have tried the acid, in a saponaceous form for curculio, potato beetles, squash bugs, lice on hogs and sheep, as well as mange, and in every instance been successful. With lard, wax or any such accompaniments for cuts, ulcers and cutaneous diseases in general it has no equal.

I beg to suggest that it becomes a duty in this association to experiment with this substance on a large scale during the coming season so as to be prepared with full reports and conclusive evidence as to its utility.

In another point in this connection I beg to call attention, viz.: the imperative necessity that exists for all the aid that can be furnished by science in our practical researches. In such momentous questions as those associated with the effects of insect life and action thoroughout all the departments of terra-culture a head is needed, not only with ample time and means at his command, but with such trained power of observation as to ensure scientific distinctness of analysis and classification, so that plain, unlettered men will have that strong confidence in his labors that can only be gained and maintained in the field of actual observation, by a corps of patient and industrious and most critical observers, and we find these requirements in the State Entomologist. Desultory, unarranged facts but bewilder and confuse and lead to no assured results. Science is the orderly arrangement of practical facts. We are particular in calling attention to this because it is a life struggle between the loathsome insect and man for possession of the fairest, finest and most desirable products of the garden, forest, field and orchard. Our position is such that we can hand down our inheritance in the soil as a loathsome, deceptive curse, or as beautiful and desirable as Eden itself, a storehouse of treasures that are as pleasant for the eye, as good for food.

In our relation to insects, weeds and fungi we find the actions and re-actions of the social compact more distinctive than in any other, and in this we discover most powerfully the incentives to associative action. Next to the importance of our own industry and intelligence comes that of our neighbor.

What matters it what I know and how much I know or do if my neighbor's ignorance, laziness or incapacity renders his lands unproductive of valuable crops, and a nursery of insects, weeds or fungi to become a curse to all of his associations.

The purse, all of the most selfish as well as the most christian impulses would lead us to a safe and satisfactory solution of the question, "Am I my brother's keeper?"

Adjourned.

AFTERNOON SESSION.

The special order for the election of officers being up, Mr. Peabody said he was glad the society had got out of the rut of St. Louis. The Secretary and Treasurer should probably reside in St. Louis. But he thought it best that St. Louis should not monopolize the presidency of the Society. In a very beautiful tribute to our honored fellow-citizen, Mr. Peabody nominated for President of the Missouri State Horticultural Society, Hon. Henry M. Vories, of St. Joseph, who, he said was eminently qualified for the office and greatly devoted to horticulture.

Judge Montague, on behalf of the St. Joseph Horticultural Society, of which Mr. Vories is President, returned thanks for the honor conferred on their society by the selection of Mr. Vories, whom he complimented as worthy in every respect and competent to fill the place.

There was no other nominee, and Mr. Vories was unanimously elected.

Judge Montague nominated Mr. C. H. Mansur of Chillicothe, as Vice President for the Seventh District.

The other nominations were then offered in the names of the present Vice Presidents as follows:

First Congressional District, N. J. Coleman, St. Louis, Mo.; Second Congressional District, T. W. Guy, Sulphur Springs; Third Congressional District, G. B. Clark, Potosi; Fourth Congressional District, D. S. Holman, Springfield; Fifth Congressional District, F. A. Nitchy, Jefferson City; Sixth Congressional District, G. S. Park, Parkville; Seventh Congressional District, C. H. Mansur, Chillicothe; Eighth Congressional Districh, O. H. P. Lear, Hannibal; Ninth Congressional District, Wm. Stark, Louisiana.

The ballot was taken, and these gentlemen were elected unanimously.

The question was raised whether ladies had a right to vote.

The President said that all members had that right.

Mr. Murtfeldt apologized for the Society for having failed so far in inviting the membership of the ladies, and then stated they were eligible and had the same right as gentlemen.

Mr. Peabody said that at the meetings in St. Louis, ladies were not only members, but that, when he was President, he had put them on important committees, especially that on flowers.

Other gentlemen made complimentary speeches about the ladies.

Mr. Murtfeldt, in a few complimentary remarks, nominated Mr. Wm. Muir for re-election to the office of Secretary.

Mr. Muir was unanimously elected.

Judge Montague said as the present Treasurer, Mr. John H. Tice, had advanced a considerable amount of money for the Society when it was uterly impecunious, and thought that was the kind of a treasurer they needed. He therefore nominated Mr. John H. Tice for re-election as Treasurer. Mr. Tice was elected without opposition.

Mr. Murtfeldt spoke of the low condition of the treasury, and the necessity of doing something to raise more funds. He proposed that the next Legislature be applied to for a small appropriation to assist the Society in its work. He cited the encouragement given to Agriculture and Horticulture in Illinois, and urged that the Society should attempt to work our State up to the same condition of liberality and encouragement to horticulture.

Mr. Z. F. Reagan, of Independence, said the Society was too modest to ask anything, and perhaps thus deserved to get nothing. He gave some history of the Indiana State Horticultural Society, which once asked the Legislature of that State for a donation of five hundred dollars, which the Assembly refused to give. The next time there was an election the people refused to return the members who were opposed to horticulture, and when the matter came up again, the Society got $2,000. He suggested the same proceeding for this Society.

Col. Mansur moved the appointment of a committee to memorialize the Legislature on the subject of an appropriation for the benefit or this Society.

Judge Montague moved to amend by adding that the Governor be asked to make a recommendation to this effect in his annual message.

Some one asked, "which Governor?"

Judge M. said the present Governor might recommend it with influence.

Mr. Murtfeldt suggested that the new Governor, B. Gratz Brown, should be induced to exert his influence for it.

The motion of Col. Mansur was adopted as amended.

The following paper was then read on

THE FERTILIZATION OF THE QUEEN BEE IN CONFINEMENT BY ANY DRONES DESIRED.—BY L. C. WAITE, ST. LOUIS, MO.

In looking around us and beholding the rapid strides which have been made in the improvement of all means of commerce, trade and agricultural pursuits during the last fifty years, the natural inquiry that presents itself to the human intellect is, how were these things dispensed with in years gone by?

The steam engine, which propels the swift steamer along the rapid current of our rivers, or across the stormy billows of the ocean, or drags the palatial coach or heavily freighted car along the iron highways of the world; whose puffing is heard in the stillness of the vast forests, converting its mighty monarchs into the useful timber for the improvement of our farms; the various agricultural implements, which lighten the labor of the tiller of the soil; the sewing and washing machines, and the wringer, which do away with the drudgery of household duties; the telegraph, which annihilates space—all add to the wonderment, and when we feel that they are necessities to us, we mechanically ask, what would the world do without them?

Men have even come to the aid of nature, and the result is that even amongst the useful animals, the stock is so improved in every respect, whether for the table, or for use in the ordinary pursuits of life—the pursuit of pleasure—that perfection in kind is nearly arrived at.

Horses, cattle, sheep and swine, certainly now are not subject to the reproach to which man is—that of deterioration; but the fine qualities developed, the enlarged size, the increased speed, together with the beauty and symmetry of form, all stamp the animals of today as far superior to their ancestry of half a century ago.

All this has not been accomplished by leaving nature to herself, or the creatures to the simple effects of their own native instincts. Years of careful study, a life time we might say, spent in carefully noticing the effects of handling, association and other extraneous circumstances by which animals have been surrounded, have each helped to bring it all about. Nor has it been the result of chance or accident, as has been the case with many of the important discoveries of modern times. The stock breeder and the farmer are practical men of science, who have gradually but surely worked up their respective callings to their present exalted positions.

Improvement marks their progress day by day, and as the world increases its desires, the means of supplying the demand go hand in hand with its growing wants.

Of late years a new tide has set in of great importance to the world in its own humble way. Progress made in the improvement of stock has given an impulse to another branch of agricultural science, and what was overlooked, or if looked at all, only treated as something not worthy the attention of great minds—something to pander to the appetites of epicures, and not for the beneficial results to arise therefrom, has begun to attract attention from even those who deemed it only fit occupation for feeble minds or the dainty fingers of woman. Bee culture has begun to assume its proper place in the deliberations of the farming world, is daily assuming larger proportions, and the dream of Huber is becoming a reality.

How to increase and improve the stock and enlarge the product of the hive, have become a consideration in the minds of apiarians.

To prevent the deterioration of bees, as has always been the case when left to themselves; to procure such as will increase the supply of honey, and to get such of the useful and interesting little creatures as will combine docility with great usefulness; and whether, as in the case of animals, man can control all this, is now occupying the minds of many of our fellow citizens. These reflections bring us to the consideration of our subject: "The fertilization of the queen bee in confinement with any drone selected."

There is no doubt whatever that the fertilization of the queen bee can be controlled, as a great many of the leading apiarians in this country, as well as in Europe, have succeeded in so doing—in adopting the method discovered and originated by America's noted bee writer, Mrs. Ellen S. Tupper, of Brighton, Iowa. In our opinion the discovery is next in importance to the movable-comb hive, the greatest improvement ever made in bee culture.

There is no question but that the Italian bee is superior to the native or common black bee. It is not necessary to give the points they possess of superiority over the black bee, as all who have kept them seem agreed that they are better in every respect. But the question naturally arises, why are they better? Simply because some attention has been given to their breeding—or, because all the inattention has been given to the breeding of our native bee. Queens must have mated with drones from the same hive for years.

Not long ago we came across an old gentleman in this State who had kept bees nearly all his life. He came to this State from Kentucky over twenty years ago, and brought with him a colony of bees. He informed us that the half dozen hives before us were "Kentucky bees," as they were all raised from the original stock—that they were more gentle than any bees he had ever seen, but some how or other they did not put up as much honey as they once did, and the reasons and wherefores he could not give. Upon inquiry, we discovered that no other bees were kept, or had been kept, within ten miles of his place for the last fifteen years.

His "Kentucky bees," as he was pleased to call them, were the most puny things we ever saw; they had hardly energy enough to sting, because they had become so enfeebled by "in-and-in breeding" that degeneracy had not only set in, but was slowly and surely running out his stocks.

Is it any wonder, then, that so many poor stocks are found, and that our native bee is not in as high a state of physical vigor as the Italian?

We can now not only improve our native bee but can keep the Italian pure, even where other bees abound. There is room for improving the Italian race also. We can avoid "in-and-in-breeding" entirely. It prevents all loss of queens when flying. We will soon be able to fix the type of the Italian bee so that they will all show the same markings and disposition.

To do this, without controlling the fertilization of the queen, is almost impossible; as it is necessary to select the best of its race, both male and female, to breed from.

But, will farmers, as a general thing, take the trouble to breed their bees up to the standard point if the way to do so is shown to them?

We are a little skeptical on this point; at any rate, we will now proceed to describe how the fertilization of the queen bee can be controlled.

The idea is just this—a young queen will be fertilized in confinement if shut up about the time she would have flown, providing, of course, that a drone of the right sort is confined with her.

It is necessary to make a fertilizer of some kind, large enough to allow the queen and drones to fly around in. It is best to make them of fine wire cloth, say twelve inches long by seven inches in diameter—size immaterial.

If coarse wire cloth is used in making them, the queen will be apt to be caught and held by the workers until she starves; workers sometimes pull the wings and legs from their own queen. We mention this so that the necessity for using fine wire cloth may be seen.

A wire cloth dish cover, ten inches in diameter, is just the thing for the purpose; they cost but little and can be easily fixed by fitting a piece of thin board in the bottom, in which a door large enough to put in one's hand should be made, Fasten on the inside of the fertilizer a piece of empty comb (drone comb is best) three or four inches square, which, when required for use, fill with honey and water—taking pains not to drop any honey in the fertilizer, or the queen and the drones will become daubed up so as to prevent them from flying.

From close observations it has been discovered that in the spring and summer young queens leave the hive to meet the drones for impregnation, usually on the fifth day; in the fall months they very seldom leave until seven or eight days old.

On the morning of the day that a queen is to leave the hive, put her with four or five drones into the fertilizer.

In selecting the drones to be put with young queens, great care should be taken to choose only those that are strong, vigorous and well marked, and they should be caught as they are about to leave the hive—those returning from a trip are generally too tired to be serviceable.

Having got the queen and drones in the fertilizer and everything fixed, lay it over the frames of the hive to which the queen belongs, so that the heat from the hive can get into it. If a dish cover fertilizer is used, put the round side downwards.

Put on the cap, which should have an opening in the side or top, covered with glass to admit light.

Leave her there thirty-six or forty eight hours—a shorter time usually answers; when a dead drone is found, examine it, and if the generative organ is gone, the queen can be released, when she will go down into the hive and begin to lay in a few days, or she can be introduced to a neuclei hive, which can be done in a minute by giving the bees in the neuclei a dose of smoke, where she can be kept until wanted.

Fertilizers can be put on any hive, and two or three can be put on at a time if the space is large enough.

If any are in doubt about their queens becoming fertile, they can easily prove the matter by clipping the wings of the queen; or, better still, confining her with all the bees until she begins to lay.

We had over one hundred queens mated this season, in complying with the above directions—twenty of which were mated before our eyes.

Those that go to work and raise a large batch of queens in nurseries and expect to have them fertilized by the wholesale, need not be surprised to find out that they have got a large sized elephant on their shoulders, and that instead of accomplishing their object, they lose the whole lot.

How do we know but that young queens need exercise for full development, and for the want of it a failure in having them fertilized in confinement will be the consequence?

In our opinion, it is best to allow young queens to run with the workers until four days old, when the queen bees and all can be confined until the queen is ready to be put into a fertilizer or she could be caught and put into a queen cage until six or seven days old, when there could be some prospect of success.

We have endeavored to describe the methods as minutely as possible, and in as "come-at-able" a way as we know how.

Those having an accurate and thorough knowledge of the nature and habits of the bee, will not only succeed with it, but should try all the experiments within their power to perfect the method for the benefit of apiarians generally.

Our object and desire has been throughout to advance the cause of bee culture, and if our remarks on this subject shall awaken any interest in the matter, however slight, we shall feel amply repaid. The care of these wonderful little creatures, always uppermost in our mind, is a study replete with interest and amusement, and will always repay the keeper's most diligent and faithful perseverance.

Mr. Midor, of Jackson county, while admitting the facts and arguments of Mr. Waite's essay, thought it did not go far enough. He (the speaker) had spent thousands of dollars for reports on this subject, which were based on insufficient experiment. His experience for a long time in the culture of the bee had demonstrated that favorite bee theories which had prevailed for the last two hundred years were erroneous. But he would not ask the Society to give him the time necessary to discuss this question as he would like to.

ORCHARDS AND SMALL FRUITS.

Mr. Peabody spoke upon the subject in the view of whether the orchard pays. He was sure it did pay in the matter of the pleasure afforded to the lover of the beautiful in nature; but as to the pecuniary profit, it depended upon circumstances, and very much on the contiguity of a market. If a man has winter apples in his cellar, he can keep them till the price suits him; but if he has pears, his chances for getting them to market diminish; if he has small fruits the necessity for immediate sale diminished his chances for making them profitable.

It was agreed at this stage to confine the discussion to the question of

PEAR BLIGHT.

Dr. Howsley, editor of the Leavenworth *Western Gardener*, discussed the question of pear blight. He had endeavored to collect facts on this subject in his section of country, where pear blight had lately prevailed to a serious extent. A committee appointed by the Leavenworth Horticultural Society, composed of W. H. Howsley, J. Stayman and J. T. Lockwood, visited many orchards, and reported the following facts as the result of their observations:

1. Pear trees blight more than apple trees under the same circumstances, although apple trees have suffered much the present season.

2. Pear trees blight most from six to twelve years old, but will blight at any age under twenty.

3. They blight less in lands where *clay* predominates. Sand and gravel add to the non-blighting qualities of the land.

4. They blight less in sward than in cultivated lands, and the more *thorough* the cultivation the worse the blight.

5. That those varieties which make latest grown and greatest amount of young wood, blight the most; and those making the least amount of young wood, provided it be healthy and well ripened, the less the liability to blight.

6. The varieties found to be most affected were Glout Morceau, Vicar of Winkfield, Catilac, Flemish Beauty and Buffum. Those least affected were White Doyenne, Beurre d'Anjoy, Beurre Diel and Duchess d'Angouleme.

7. At some of the grounds visited we found considerable blight, at others but little, and at others none at all. These four instances where no blight was found, were the grounds of F. Goddard, Wm. Bacus, J. T. Lockwood and Dr. Howsley.

8. Trees blight worse in low lands, especially if it is inclined to be marshy, than on high lands, other things being equal.

The chairman visited in person various portions of Kansas and Missouri, and in connection with his personal observations, has addressed many intelligent pear growers on the subject, putting questions to them in regard to the facts above stated. In all of his own observations the facts gathered most fully confirm the facts above set forth.

Dr. Howsley argued that our lands were too rich, and that trees grew too fast. Sandy and clay soils should be selected. There was no mystery about it if we only investigated the subject by experiment. The blight ensues the season after the cause. But there were various causes. One was the system of pruning so that the tree may spread or become dwarfed. The roots take up too much sap for the branches. Too much cultivation was another cause, leading to a like result, especially in wet seasons; which, added to warm, wet autumn influences, causes a large quantity of sap in the tree, which may be frozen by cold weather, rupturing the sap-cells when the sap oozes out. One is not apt to discover the condition of the tree till the next spring. When the sap reaches the terminal bud at the end of the branches, after it commences to move in the spring, it is turned and descends between the wood and bark; it is arrested in its course by the rupture of the sap-cells caused by freezing the previous winter.

Rains and the intense heat of the sun caused the sides of the trees exposed to the sun to become bark burnt or scalded and the sap-cells were obstructed as in the case of freezing. Thus we have the freeze, blight and the sun-scald blight. The twig blight he did not regard as deleterious, as it generally caused a larger crop of fruit the next year.

Dr. Stephens, of St. Louis county, gave his experience with two trees. A pear tree which presented blight in the bark was cut off several years, but developed blight until it was only two inches above ground. The next year it shot up a sprout. This eventually developed blight, and he gave it up. He had an apple tree in which blight was developed pretty low down. With a spade he hilled up the tree to a point above the blight, and it got well. Dr. S. drew some practical inferences from this experience, but would rather have the opinion of the Society.

Mr. Lewis controverted the idea of descending sap. He didn't understand how it was possible.

Mr. Tice stated that if a tree was banded, or ringed, in the spring, it would grow above the ring and not below it.

Dr. Howsley made some remarks illustrative of the same fact.

Dr. Spalding made an interesting address on the subject of pear blight, and took issue with Dr. Howsley in regard to the freeze blight. He cited examples to confirm his opposition to the position taken by Dr. H., who responded that if time were given him he would prove to the satisfaction of all that his theory was correct.

EVENING SESSION.

Dr. C. W. Spalding defined the word *blight* as a perishing of a portion or the whole of a tree. There are three diseases called pear blight. I give it that name because it is generally understood. Fungus growth distributed by spores-seed—the seeds of microscopic plants called fungi, falling upon the pear tree planted in good ground, they will grow most readily on a young tree, the bark of which presents the best surface to fall upon, consequently it is more liable to its ravages. I take the ground that the disease is entirely external, and consequently we must present such a surface on a tree as will best resist the attack of these spores. We cannot avoid the existence of these spores in the atmosphere, and if we can not, then we must fight them with the best means at hand. We must scrape off the fungus, or use a wash of salt or other effectual wash. But the amputation does not have the effect to prevent other seeds of fungus from falling on the same or spots near by and growing. Among pear trees near the ocean, where salt is prevalent in the atmosphere, pear blight is not so prevalent as in places remote from the ocean.

How shall we produce the progress or best condition for the tree to resist the attacks ?—seeding down poor land, poor cultivation—that may produce pears, but will not produce fine fruit. Good fruit is desirable, and cultivation in the early part of the season may be necessary. We want to produce the season growth early, so that we may have a perfect formation of the terminal bud. We should avoid late growth. Root-pruning is preferred, to produce the desired result. If the tree be of bearing age, say three inches in diameter, then we will strike a circle of three feet, within which to prune the root.

Dr. Clagett said he had given considerable attention to the subject of pear blight, but the further he progressed the more he got into the dark; and this seemed to be the case with those with whom he had corresponded on the subject. The dwarf trees were liable to a species of blight that the standard trees were not subject to. Dr. Clagett gave an interesting statement of the process of the tree-growth, and gave some curious facts about the peculiarities. One luxuriant Flemish Beauty pear tree on his place attained a large luxuriant growth before it bore any fruit. Then he was pleased to see it loaded with pears, which all came to maturity; but before it ripened the leaves fell off. The next season it died. On digging up the roots, they were found to be not only dead but rotted. Several instances were stated in which branches of trees continued to grow after the bark had been stripped for a length of two feet from the lower part.

(A five minutes rule was here established.)

Mr. Muir professed the theory that the disease called "blight" was the result and not the cause of the fungus. He cited instances proving this theory.

Mr. Riley, in a few pointed remarks, opposed the fungus theory.

Dr. Howsley took the floor (without restriction to the five minnutes rule) and defended, at some length, his position in regard to freeze-blight. He gave historical instances in which the pear trees were killed by blight induced by extra cold winter. The winters of

1844, 1862 and 1868, were cited as extremely hard winters on pear and apple trees, and the effect was mournfully perceptible in the springs following those years. The speaker controverted Dr. Spalding's theory of root pruning to prevent blight. It would increase the fruit-bearing power of the tree for a few years, but the early effort would be the death of the tree. Fungus never commenced on a healthy tree (which was the basis of Dr. Spalding's theory), but was the result of disease already set up on that part of the tree where the fungus appeared. Dr. Howsley also replied to the position taken by Dr. Clagett.

Dr. Howsley concluded by saying that he was preparing a paper to be read at the Kansas State Horticultural Society, a copy of which he would send to Dr. Spalding, and the Doctor could open his batteries of root pruning and fungus upon him. He would be found ready for the battle as long as life lasted.

Mr. Guy offered the following:

Resolved, That we have heard the subject of pear blight amply discussed, of which we knew nothing at first, and know nothing now.

Judge Montague moved to amend by making the resolution read that "we were opposed to pear blight."

Mr. A. H. Vories moved that the resolution be deferred till after Dr. Howsley's paper and Dr. Spalding's reply to it were published, when we might "know" something about it.

The resolution was withdrawn.

HERD LAW.

Mr. Murtfeldt offered the following, which he advocated at considerable length, in the course of which he stated that the fences in the State of Missouri cost more than all the buildings in the State, including those of the cities:

PREAMBLE AND RESOLUTIONS OFFERED BY C. W. MURTFELDT, OF ST. LOUIS.

WHEREAS, It is a notorious fact, patent to every observer, that the annual destruction to field and garden crops, as well as of orchard fruit and ornamental trees, shrubs and flowers, in the State of Missouri alone, amounting to hundreds of thousands, if not a million of dollars annually, consequent upon the unrestrained running at large of domestic animals; and,

WHEREAS, Such animals are turned out ostensibly to pasture upon the highways and the lands of non-resident owners, but really to get a living at any rate; and,

WHEREAS, These animals at certain seasons of the year, much prefer to feed upon corn and other growing crops (not always their owner's) to the scanty pastures of the highways or the frost-bitten wild grass of the sloughs, woods and prairies; and,

WHEREAS, Much contention, bickering, going to law neighbor with neighbor and brother with brother, with fighting and even murders, result from the above mentioned practice; therefore, *Resolved by the Members of the Missouri State Horticultural Society*, That we will use our best personal and collective efforts to insure the passage of a law by the next General Assembly that shall make it obligatory upon every man to take such care of his domestic animals, to wit: Horses, mules, neat cattle, sheep, swine and goats, as to prevent their pasturing upon lands not his own, whether belonging to resident or non-resident owners; unless such animals are during the entire time under the entire care of competent herdsmen.

Resolved, Second, that the expense necessitated by the enclosure of farms other than is elected by the *bona fide* owners thereof, is onerous, unnecessary and arbitrary, and ought to be abolished.

Resolved, Third, that the plea for the poor so commonly advanced in giving them the privilege to pasture the highways, is a myth and a damage.

Resolved, Fourth, that immigration into our beloved State is greatly hindered, and the face of nature sadly marred by the prevalent custom of fencing as at present practiced.

On motion of Mr. Vories, the discussion was postponed until 2 o'clock to-day.

HORTICULTURE AT THE ST. LOUIS FAIR.

Dr. Spalding offered the following, which were adopted:

WHEREAS, The annual fair of the St. Louis Agricultural and Mechanical Association have become of national importance, and are such as every Missourian may feel justly proud of; and,

WHEREAS, The members of this society are directly interested in the Horticultural department of these exhibitions, and are disposed to aid in making this department as perfect as possible in all its details; therefore,

Resolved, That a committee of five be chosen by this society to confer with the officers and directors of the above named association relative to that part of our exhibition covered by our special pursuits.

Adjourned.

THIRD DAY.

The meeting was opened by prayer by the Rev. Mr. Phillips.

PLACE OF NEXT MEETING.

Mr. Hall made a motion to suspend the rules and take up the question of the place for the next meeting.

Mr. Lewis moved that Kansas City be selected; motion seconded by Mr. Taft, Dr. G. S. Park, Dr. Howsley and others.

In connection with the next meeting, Mr. Muir explained about transportation. The railroad companies are not willing to grant return passes in the loose and unsatisfactory manner in which that business has heretofore been done.

T. R. Allen nominated St. Louis, and advocated that the next meeting be held in that city.

Judge Montague explained that no man could say how passes would be granted unless he owned a railroad, and the same was true with regard to hotels and hotel bills.

Dr. Clagett yielded the chair to Vice President Park, and said that St. Louis was visited for business purposes at the time of holding the annual meeting of the Society.

Reference was made to the annual volume of the transactions, which contained all the information that was valuable, and could be had for the asking.

Mr. Vories mentioned the self-interest manifested in attending these meetings. If we are unselfish in our motives, if we are laboring in a sort of missionary work for the good of the whole State, let it be manifest. The leaven is to work in St. Louis, and it ought to be made to work in other places also.

Mr. Murtfeldt explained that missionary labor could be done collectively and personally also, and that if members were entertained one or two in a family (and you come very near a man when you are seated at his table) that such intercourse would be productive of good results. Such was the practical working of the Illinois Horticultural Society, which was the most efficient, the leading, the first society of that kind in the United States.

Dr. Spalding explained that in their Society it was so because it had the most earnest and interested workers.

A vote was then taken on the motion to meet at Kansas City, and the vote was unanimous to hold the next annual meeting at that place.

TIME OF NEXT MEETING.

Mr. T. W. Guy moved that the time be not fixed, but left to the President to set the day.

Dr. Clagett pointed out serious objections to this mode, and suggested that time be fixed now.

Mr. Hall moved that the second Tuesday in January be fixed as the time for the next meeting.

Mr. Medor wanted the time fixed early, so that there could be a display of fruits and vegetables, which it was desirable to have, when the Society met in his county. He suggested the second Tuesday in November.

Mr. Vories named the second Tuesday in September, when there could be a fine display of flowers and fruits.

Dr. Clagett urged that the meeting should be held at a time when a good attendance of members could be secured, rather than a good display of products. "They wanted the intellect of the Society and those interested in horticulture rather than specimens.

It was agreed to adopt the time fixed by the Constitution—the second Tuesday in January.

PEAR BLIGHT AGAIN.

Mr. Vories introduced Mr. Wright as well posted on pear blight. Mr. W. said he had paid attention to this subject for fifteen years. For ten years of this time he had changed his opinion every year. He now believed the fungus was the result and not the cause of the blight. The cause was atmospheric. The freeze-kill was not pear blight. The result was the death of the tree in the spring in case of freeze-kill. He attributed the real pear blight to dry winters—the lack of moisture, when evaporation was greater than absorption—and cited Holland and Belgium, where there were an excess of moisture, and pear blight is unknown.

T. R. Allen, of St. Louis county, read an essay on

SCIENTIFIC CULTURE OF THE SOIL.

Mr. President, Ladies and Gentlemen of the Missouri State Horticultural Society:

I find myself on the programme for the above subject. The term culture being a very indefinite one, I take the liberty of amending by stating it as Scientific Culture of the Soil.

Many seem to take alarm at the use of the term Science when applied to agriculture or the culture of the soil. It seems to them too learned and abstruse; too difficult to be understood by plain farmers. Science is simply knowledge; "truth ascertained; that which is known." It is just the opposite of theory. Almost every man you meet has a theory; but who has knowledge? The man who by patient investigation, observation and practice comes to a true knowledge of facts. Then he arrives at positive knowledge, he no longer guesses about a thing; theory is no longer of use to him on that particular subject; he knows it is thus and so. Not so with the mere theorist. He is beating the air, reasons in a circle, and his conclusions are ever unreliable; in short, he is a man of theory, of uncertainty and not of knowledge. But it is with that branch of science called *applied science* that we as agriculturists or horticulturists have to do; that kind of knowledge of facts, or phenomena, as explained, accounted for, or produced by means of powers, causes, or laws. For illustration: I want a ditch dug of a given length, depth and width; required the cost. I employ an able bodied man, accustomed to such work, at a given price per day, give him a spade, and set him to work, and see that he does a fair honest day's work.

I measure his day's work. Now, I have a plain problem in single proportion, thus: if a man can do so much in one day, how many days will it take him to complete the ditch?

Again: I want to know the effect of a given quantity of a given manure on, say an acre of potatoes. I measure off two acres of ground of the same quality as to fertility, and of like exposure; I plow it all alike, prepare it for the seed in the same manner, and plant all the same day with the same seed. But to one acre I apply my manure, to the other none, or a less quantity, or a different kind, as I may at the time elect. Now, I cultivate all alike, harvest at the same time, measure or weigh the product, and note the result.

Here, I have an ascertained fact, derived from experiment, the result of a cause. It is true that experiments of this kind may have to be repeated through a series of years, together with the notes of the temperature, the amount of rain fall, time of planting, modes of culture and times of harvesting, etc., before the results can be implicitly relied on, but we are all the while ascertaining interesting and valuable facts not to be obtained in any other way. We are thus gaining knowledge, it may be slowly, and costly, in time and money, but when obtained, it is valuable, it is truth ascertained, and not a fine spun theory. Would that we had more of this kind of knowledge; knowledge obtained by experiment and observation, not in one department alone, but in all departments of agriculture. We all have our theories—some of deep tillage, some of drainage, others of manures, others of rotation, others of the time and mode of planting, pruning, grafting, etc. How many of us have knowledge; ascertained by patient and thorough experiment? The number, we fear, is lamentably small. Are we not all too much inclined to adopt some man's fine theory, rather than take the trouble to investigate for ourselves?

Again, the old aphorism, that like begets like, is a sententious way of expressing a universal law of nature. The Great Teacher adverted to this law, when He asked the question, "do men gather grapes of thorns or figs of thistles?" The intelligent breeder of domestic animals appreciates this law. When he has formed his idea of the points and characteristics he wishes to unite in one, he selects those to breed from which seem to combine most of these qualities.

But how many of our farmers think it worth their while to go into the wheat field before the crop is harvested, and select by hand some of the earliest, ripe and best developed heads for seed? How many go into the corn field before the crop is fully ripe and select the best ears for seed? How many are endeavoring to improve the seed of all the crops they attempt to grow by some such method as this? How many of our nurserymen select only the well developed comely shaped, healthy, vigorous stocks on which to graft, rejecting all weakly, sickly, insect-eaten things that ought to be committed to the flames, especially when stocks are scarce and of high price? Then, if like produces like throughout nature, how can we expect a perfect crop if we plant imperfect seed, or a healthy tree if we graft on a diseased stock? We might as well expect water to run up hill. It is high time that the idea be exploded that farmers and horticulturists have nothing to do with science. If they have not use for science in the best and most practical sense of that term, I would like to know who has? The theologian has to study the Divine law in its special relations to the human soul; the lawyer has to study human laws, which are necessarily imperfect; physicians must study the laws of life, and the phenomena of disease, and their remedies, but the farmer, while not entirely neglecting any of these, should study those natural laws to which all the productions of the earth are subject, and which are invariable and indisputable. It is from the soil we derive all that constitutes our wealth. "Of all the material gifts of the Creator, the various productions of the vegetable world are of the first importance." Hence, how important the knowledge of the laws of vegetable life? How strange it seems that the idea should ever have become so prevalent that farmers have need of but little learning; that the stupidest boy in the family would do for a farmer, and that it was not necessary for him to go to school or college. The brightest one must be a divine, a lawyer, or a doctor, and he must have a scientific education, and yet neither of these so-called professions have need of half the scientific knowledge that the farmer requires. Hence, it is not strange that so large a proportion of our agricultural lands that were once fertile, are now so unproductive that they have been, or soon must be abandoned by their owners. Thus, our only great source of wealth, prosperity and happiness is being diminished instead of increased as it might be if we possessed the necessary knowledge. It is generally admitted that a previous training is necessary for all professions or occupations except that of the farmer. The boot maker, the tailor, the hatter, the blacksmith, the carpenter, the machinist, the engineer, the sailor and the merchant, and many others, each requires an apprenticeship of several years to be prepared to enter upon the discharge of his duties.

And yet, farming, strange to tell, is thought to be so simple, or so natural to everybody, that no previous training is required.

Many years ago, before there were any railroads in the West, I was driving my team with a load of marketing to St. Louis, and when within eight miles of the city, in a field by the roadside, I saw a man trying to sow oats broadcast. He had his seed in a large sack, two of the corners of which were tied together and swung on his right shoulder and against his neck, the seed then hung in the centre of the sack on his left side down about his knee, so that when to get a handful of seed he had to stoop to it with his right hand, then straighten himself up, when, instead of sowing the seed broadcast, he threw it down in a heap here and there at irregular intervals. I looked at at the man first with astonishment, then with amusement, and finely with pity, until I had passed him a few rods, when I stopped my team and went to him, accosted him courteously, and remarked that I perceived that he did not understand sowing oats broadcast. He very readily acknowledged that he did not. I proposed to show him if he would allow me the pleasure, to which he most cheerfully assented. I took the sack, hung it on my right shoulder as he had it, but instead of allowing it to swing under my left arm, divided the grain across my left shoulder, holding open the mouth of the sack with my left hand, so that my right hand had easy access to the grain, while in an erect bodily position. I then showed him that as I brought my left foot forward I threw the seed with my right hand, letting it pass between my fingers, distributing it evenly in the air before it fell to the ground.

This man had made some money at some previous occupation, which he doubtless understood better than he did farming, and had invested it in a snug farm within eight miles of St. Louis, no doubt with a view of living comfortably and indendently, if not luxuriantly, not even dreaming that a previous practical training was necessary to become a successful farmer. He soon found himself sadly mistaken, and was most heartily disgusted with the business, sold his farm at the first opportunity, and sought an occupation more in consonance with his previous training.

Many similar instances might be given, but this one must suffice for the present occasion. It simply illustrates an important fact lying at the very foundation of successful agriculture. We, as agriculturists and horticulturists, need previous practical training, as well as the type-setter or the wheelwright. It is indispensable to success. And it is through this process, and I think I may say only through this that the science or true knowledge is attained. Then, if I am right in my premises, it follows as a matter of course that the practice and science should be pursued together and at the same time, and the more science the better. Neither can well be dispensed with, but if we can have but one, by all means take the practical training. This alone will necessarily involve much of science without the technicality of the name. I have three sons, all good boys, obedient, industrious and studious. I am trying to give them the best education the facilities of our country affords. I am frequently asked what professions I design for my sons. My reply uniformily is, that I am trying to educate them for farmers, but after I have done for them all that I can, if they have not sense enough to be farmers, they can choose a profession for themselves.

Mr. C. W. Murtfeldt said:

Mr. President: Being a modest man, I have waited to see if gentlemen would rise and discuss the excellent and practical essay of Mr. Allen on "Scientific Culture," or in his altered phrase of "Scientific Cultivation of the Soil." I for one am not willing to let this topic go by without discussion, or without referring to one fact, namely: That Columbia, the seat of our State University, has carried off the Agricultural College. In this institution we hope to have not only a Professor of Agriculture, but also a Professor of Horticulture; we hope to have a model orchard, a model nursery, greenhouses and hothouses for tropical plants, and all the appliances for scientific study and research. We, as horticulturists, should have "*excelsior*" for our motto; we should not be satisfied with the standard to which we have attained, but have a higher standard of excellence. We may have to go through the "*grinding process*," as Illinois has done, because agricultural and horticultural professors do not hang upon every bough, to be had for the picking; but we will have them, even if a Normal Agricultural College has to be established to manufacture them, if I may be allowed the expression. Now we ought to encourage our Agricultural College of Missouri by sending there our sons, and using our influence for its greatest success.

Col. Park was glad the subject of scientific culture had been brought up, and so prominently and favorably as Mr. Allen had done. Through such papers the transactions of this society were to become more valuable.

Mr. A. H. Vories remarked that there was too much of a disposition to educate our daughters to keep them out of the kitchen, and our sons out of the field—in other words to spoil them. For himself, he had learned to hold the plow, but got tired of that and finally got to be a lawyer, which profession he had followed for twenty years, till now he had advanced, and got back to be a farmer. He had devoted the present week to the meetings of this society, in the hope of experiencing pleasure in the consideration of subjects connected with his occupation. In connection with this subject, he proposed the question: "What effect has different articles of food on the mental and physical development of man?"

Mr. Clagett argued that the society should adopt some method to make the next meeting *pay*. To this end he suggested that members should make experiments in important departments of horticulture during the interim between this time and the next meeting, and report. This he believed was the best means of making the meetings pay, and knowledge could be thus gained that will be valuable to horticulturists everywhere.

Judge Montague argued that young men should be taught that the "professions" were not the highest attainments in life, and commended the Agricultural College as a means of inculcating this idea.

Mr. Humphreys, of Macon, offered a resolution commendatory of the sentiments of Mr. Allen's essay, and eulogizing the Agricultural College.

Col. Park spoke of the ability of every member to bring up something before the Society that could be made of value. The experience of every man in horticulture was valuable, and the experience of the whole body of its members could certainly be made so.

Mr. Allen said that the Agricultural College, which he recently visited at Columbia, thirty acres of a beautiful tract had been laid out in a garden to further the interest of horticulture. While he was there the class in horticulture was taken out to a lesson in pruning.

Mr. Allen arose, he said, to call the attention and solicit the sympathy of this Society in favor of the Agricultural College. Boone county had donated 640 acres of well improved land, with a fine residence upon it; the county had also donated $30,000 for the organization of professorships. The College was of more importance than was at present appreciated, and he hoped the members of this Society would do something towards bringing it into notice.

Dr. Spalding was in the fear that our State Agricultural College was about to fall into errors that had retarded the usefulness of similar institutions. The Doctor criticised the managers of the College because they seemed to ignore the experience of the College of Illinois, Michigan, and others.

Judge Montague said the College should be managed by scientific and practical men. To this end he suggested that this Society make an endeavor to exert some influence in the selection of the Board of Curators.

The resolution of Mr. Humphreys was adopted.

Col. C. H. Mansur, Judge E. J. Montague and Mr. Chas. Peabody were appointed by the Chair a committee to memorialize the Legislature on the subject of an appropriation for the benefit of this Society.

WINE REPORTS.

Dr. Spalding of the Committee on White Wines, reported as follows:

REPORT OF COMMITTEE ON THE WHITE WINES OF 1870.

The committee had before the following wines:

No. 51, Light Concord, exhibited by A. E. Trabue, of Hannibal; grade 63¾.

No. 41, Light Concord (No. 1), exhibited by Stark & Wood, of Louisiana, Mo., grade 67½. This sample was fermenting and hence not in good condition for trial.

No. 1, Light Concord, exhibited by T. W. Guy, of Glenwood, Mo.; grade 68.

No. 2, Light Concord, exhibited by T. W. Guy; grade 83¾.

No. 24, Light Concord (No. 2) exhibited by Dr. H. Clagett; grade 70.

No. 4, Light Concord (A), exhibited by T. W. Guy; grade 63¾.

No. 44, Catawba, exhibited by J. & A. Horning, of Westport, Mo.; grade 61¾.

No. 32, Catawba, exhibited by Joseph Zeigler; grade 71¼.

No. 14, Catawba, exhibited by N. Grien, of Gasconade Ferry grade 77½.

No. 38, Catawba, exhibited by Jacob Madinger, of St. Joseph grade 52¼. This sample was fermenting, and therefore in bad condition.

No. 17, Rulander and Taylor mixed, exhibited by N. Grein; grade 86¼; a good wine.

No. 35, Delaware, exhibited by Jacob Madinger; grade 82½.

No. 49, Goethe, exhibited by J. & A. Horning; grade 63¾.

No. 19, made from a seedling of the Traminer, a well-known European grape, exhibited by N. Grien; grade 90.

This last sample is a light colored wine of high quality and more nearly resembles the higher class of Rhine wines than the wines produced from our native species, and is certainly encouraging to those who are engaged in producing seedlings from European varieties.

In conclusion your committee cannot refrain from expressing the opinion, that wines as a general thing, of the vintage of the current year are too immature for exhibition at the time of our annual meeting.

All of which is respectfully submitted.

C. W. SPALDING, *Chairman.*
S. F. TAFT.
BENJ. L. STEPHENS.

NEW RED WINES.

The following report was read and received:

Mr. President of the Missouri State Horticultural Society: Your committee appointed to test new red wines having discharged that duty, beg leave to submit the following report. In making the test the number "one hundred" was employed to indicate highest excellence. By this scale your committee found the various samples of Concord wine to be of the following degrees of excellence:

No. 3, exhibited by T. W. Guy, 82½.
No. 7, exhibited by J. J. Kelly, 80.
No. 10, exhibited by H. M. & A. H. Vories, 75.
No. 18, exhibited by Nicholas Grien, 70.
No. 23, exhibited by H. Clagett, 85.
No. 27, exhibited by H. Clagett, 65.
No. 37, exhibited by Jacob Madinger, 90.
No. 42, exhibited by Stark & Wood, 79½.
No. 43, exhibited by Stark & Wood, 87½.
No. 47, exhibited by J. & A. Horning (not clear), 55.
No. 13, exhibited by H. M. & A. H. Vories, 83.

VIRGINIA SEEDLING.

No. 8, exhibited by J. J. Kelly, 83½.
No. 12, exhibited by H. M. & A. H. Vories, 85.
No. 16, exhibited by N. Grien, 85.
No. 25, exhibited by H. Clagett, 87½.
No. 26, exhibited by H. Clagett, 83½.
No. 28, exhibited by H. Clagett, 90.

No. 40, exhibited by Jacob Madinger, 90.
No. 48, exhibited by J. A. Horning, 80.

CLINTON.

No. 15, exhibited by J. W. Green, 78½.

C. W. MURTFELDT, *Chairman.*

OLD WINES.

Mr. Guy offered the following report, which was adopted:

Mr. President: The Committee on Old Wines have tested the samples of wines presented to them, and report the following as the result of their general judgment upon said samples:

WHITE WINES.

No. 6, vintage of 1867, Catawba, made by J. J. Kelly, 74.
No. 45, vintage of 1869, Catawba, made by J. & A. Horning, 71.
No. 50, vintage of 1868, Catawba, made by Jacob Madinger, 77.
No. 39, vintage of 1869, Catawba, mouldy, made by Jacob Madinger, 58.
No. 9, vintage of 1867, Concord, made by J. J. Kelly, 72.
No. 5, vintage of 1869, Concord, set aside, acetic fermentation set in.
No. 31, vintage of 1869, Concord, made by H. Clagett, 72½.

RED WINES.

No. 21, vintage of 1869, Concord, Cliff Cave, 60.
No. 13, vintage of 1869, Concord, H. M. & A. H. Vories, 72.
No. 34, vintage of 1869, Concord, Jacob Madinger, 57.
No. 20, vintage of 1869 (A), Concord, Cliff Cave, 68.
No. 46, vintage of 1869, Concord, J. & A. Horning, 57.
No. 11, vintage of 1869, Concord, H. M. & A. H. Vories, 65.
No. 33, vintage of 1867, Clinton, H. Clagett, 80.
No. 22, vintage of 1869, Norton, Cliff Cave, 81.
No. 30, vintage of 1869 (1), Norton, H. Clagett, 82½.
No. 36, vintage of 1860, Norton, J. Madinger, 80½.
No. 29, vintage of 1869 (2), H. Clagett, 80.

T. W. GUY,
JOHN H. TICE.
C. V. RILEY.
T. R. ALLEN.

AFTERNOON SESSION.

The first business of the afternoon session was the discussion of Mr. Murtfeldt's resolutions recommending the passage of a law requiring every man to keep us his stock, and which is commonly denominated the

STOCK LAW.

Mr. Murtfeldt read the resolutions, and asked discussion.

Mr. Vories said he thought the question would be opposed in the Legislature by men whose constituencies lived in prairie counties. The common law recognized the principles of the resolutions; but he believed the general sentiment will be found to be against it on account of the cattle raising interest, which was fostered by the open pasturage of the prairies. Statistics show that Missouri produces more cattle than half-a-dozen of the Eastern States where stocks laws were in force. This would operate against the adoption of such a law in this State.

Mr. Allen acknowledged the force of Mr. Vories' position. Under the constitution such laws must be general. He suggested that a general law might be made which could yet be adopted by counties specially.

Mr. Vories said such a law had been decided unconstitional by the Supreme Court.

Dr. Spalding feared that no general law could be made on this subject that would suit the whole State. He thought the difficulty could only be remedied by an amendment to the Constitution, and the question of a Convention for an amendment of that instrument being now agitated, he hoped a remedy would soon be found for the difficulty.

Mr. Murtfeldt argued against the principle of a man bringing into the State a thousand or fifteen hundred head of Texas cattle and pocketing the proceeds of their fattening on somebody else's land. If these cattle should break into some poor man's field and destroy the corn in it, the poor man might sue the owner of the cattle, but would doubtless get worn out in the courts without getting redress. The spread of Texas fever was suggested as another argument in favor of a law that would prevent its propagation. He believed a stock law would quadruple the population of Missouri in ten years. The failure of the poor man's cow to "come up," caused the loss of milk enough to pay for keeping her up and feeding her. The keeping up of stock preserved the manures, which had heretofore been wasted in many of the other States. Ohio, once regarded as the Egypt of America, now reported only eleven bushels per acre of wheat yield, and had to import her own breadstuffs.

Mr. Clagett suggested that if all were of the same opinion, time would be saved by passing the resolution without further debate. He had heard no opposition.

Judge Montague spoke against the resolutions. Our State had not reached a condition to demand such a law. The stock-raising interest was too great—there was too much grass of native growth that would be left to rot by such enactments, and he urged that this would be a waste of a material element of wealth in Missouri. He did not believe such a law would be demanded till the State had a population of three or four millions of people. Land was so valuable in Massachusetts that cattle raising was not profitable. So it was of New York; but it was the other way in Missouri.

Dr. Clagett believed a stock law would promote stock raising, and cited Kentucky as an example. Herds could be guarded on the prairies and the wild grass might fatten the cattle, just as well as now. There was an effort to improve the breeds of various kinds of stock in the State; this would be promoted by the stock law, for it was impossible to keep the blood pure where the stock run at large. A herdsman could be hired to take charge of a number of cows; he would drive them to grass in the morning and return them to be milked in the evening. This would also insure the safety of the cattle at all times and cost but little. He urged that the law could be tried, and if not found practical, the old method could be resumed.

Mr. Riley has had experience in herding cattle in Illinois, and had found it difficult to to keep stock out of the fields *with* the fences. It was useless to talk about the ease with which cattle could be herded. The small farmer and the horticulturist might be benefited by such a law, but the great stock growing interest would be injured by it. In New York, where they had a stock law, they were building new fences yet. He did not believe such a law would be judicious for fifty years to come.

Dr. Spalding opposed the resolutiou. He was in favor of a law that would leave it optional with any county to avail itself of its provisions, but such a law as was contemplated by these resolutions was unconstitutional. He moved to lay the resolutions on the table.

Judge Montague said if one county adopted the law, it would be a very bad thing if the adjoining counties did not adopt it, for stock, disregarding county lines, would go over into other counties and range the unfenced farms.

Mr. Murtfeldt defended the resolutions, and denied that either Illinois or New York had abandoned their stock interest.

Mr. Medor said the question was whether it would cost more to fence the stock than the stock was worth.

Dr. Stephens believed that in ninety-nine cases in one hundred the stock permitted to run at large was worthless, and it would not pay to keep them up and feed them.

Mr. Taft made some pointed remarks in favor of the resolutions.

Mr. Muir offered an amendment to the resolution to include among the "domestic animals" which depredate on gardens and orchards, dogs, geese and turkeys, which were the worst enemies of gardens and vines. He, however, opposed the resolutions. The law would not apply to any county but St. Louis, and if it was made to be adopted by such counties as desired it, it would be productive of feuds, the extent or result of which could not be foretold.

Mr. Wright advocated the resolutions. If we could not get the law passed next winter, we could agitate the question; we could do something for the cause, and get the law after a while.

Mr. Guy moved to lay the resolutions and amendments on the table. Lost.

Dr. Peabody thought the Society ought to make some expression on this question.

Dr. Spalding moved the resolutions be referred to a committee to report at the evening session.

The resolutions were then voted on as a whole, including the ment, and adopted.

VICE PRESIDENTS' REPORTS.

Mr. Tice, of the Committee on Vice Presidents' Reports, submitted the following:

MR. PRESIDENT: The Committee on Vice Presidents' Reports have examined the various reports as far as submitted, and although finding much in them that would afford interesting and edifying topics of discussion, yet at this stage of the session of the Society, they deem it would be inexpedient to present them as such, for the reason that the discussion, to arrive at an intelligent conclusion, requires the array of a greater number of unquestionable facts than are now before it, or can be produced at present. The committee, therefore, recommend the adoption of a medium course that shall, while it defers the discussion, secure and collate the facts necessary to an intelligent understanding of the subject matter involved—namely, to appoint proper special committees to which the matter shall be referred for investigation and report, with instructions to accompany their report with the production of the facts upon which their report is based. In some reports several new varieties of fruit are mentioned, and amongst these are some claimed as new, whose origin is doubtful, and which may turn out to be only synonymous for old varieties. The committee, therefore, recommend that all fruit mentioned in said reports as new varieties, be referred to a special committee, who shall thoroughly investigate the history of the origin, or of the pretended origin of such articles; and especially to procure specimens for comparison of all such varieties as are doubtful, and who it is claimed have been erroneously rechristened in localities where their origin and true name were unknown. The committee to be further instructed to accompany their report with the specimens of the fruits whose origin and nomenclature is doubtful.

In the report of the Vice President of the Sixth Congressional district, is acommunication from G. C. Swallow, Professor of Agriculture in the State Agricultural College, in which occurs the following statement: "A soil may have an abundance of all needful fertilizers, and yet be so cold and impervious to heat and air that very little plant food can be digested and prepared for absorption by the roots of plants. On the other hand, a soil may be so loose and pervious that water percolating through it carries off the plant food in such quantities as to exhaust the soil more rapidly than constant cropping."

As the committee cannot subscribe to the doctrine advanced in the above extract without great modification; and since, if the doctrine inculcated be erroneous, and coming as it does from the great head center of Agriculture, it is mischievous if erroneous; therefore the committee recommend that this subject also be referred to a special committee, with instructions to thoroughly investigate the subject and place it upon a scientific basis, and report to the next meeting of this society.

All of which is respectfully submitted.

S. F. TAFT,
BENJ. L. STEPHENS,
L. J. MUNGER,
JOHN H. TICE,
Committee.

Dr. Park defended the extract from Prof. Swallow's letter. It was a scientific fact that there were soils so loose they would not hold manure, but let it sink and exhaust, and that there were others so hard that roots could not take hold in them. He disliked to see the society go forth in the light of controverting known scientific facts. That part of the report directed towards his new varieties of fruit, he would say nothing of.

A considerable discussion here ensued upon the last recommendation of Prof. Swallow. Mr. Tice held that the statement in the extract did not comprehend any soil of Missouri—there was no such soil here, and but little such anywhere. Plants received but a small portion of nutriment through their roots, but more through the means of the atmosphere.

Mr. Taft made the point that soils do not leak. Sand does; but sand is not soil.

Dr. Spalding desired that a committee might confer with Prof. Swallow on the point. He was unwilling that such a criticism of the Professor of Agriculture in our young Agricultural College should go out without a perfect understanding of the meaning of the statement made and now under discussion.

Mr. Tice said the idea that soil (not sand) could be lixiviated, or exhausted by leaching, as ashes having the lye taken out of it, by moisture, he regarded as a monstrous doctrine.

After some further discussion, the report was adopted.

[The following was sent to the Secretary with the request that it follow the report in the printed proceedings:]

HORTICULTURAL SOCIETY AND SOILS.

I notice by the report of the proceedings of the Horticultural Society, that a committee of that society took some exceptions to a statement of mine respecting soils, which is as follows: "A soil may have an abundance of all needed fertilizers, and yet be so cold and impervious to heat and air, that very little plant food can be digested and prepared for absorption by the roots of plants. On the other hand a soil may be so loose and pervious that water percolating through it carries off the plant food in such quantities as to exhaust the soil more rapidly than constant cropping."

In this extract there are two distinct propositions, each of which states a fact well known to cultivators in many parts of the country; though our good soils have made some believe such qualities impossible.

For many years I was interested in cultivating a farm which had two soils of the characters described. The one we were compelled to improve by the addition of sand, lime and ashes, to make it more light and porous, to the other we added clay to cure the evil.

But as the committee of the Horticultural Society did not seem to have any knowledge of such soils, I will refer to a few of the many authorities who have known them.

John Morton, than whom there is no better authority, says, "Though the soil has a full supply of animal and vegetable manure in it, yet the mechanical derangement so totally locks up all its energies that the necessary fermentation is altogether stopped, and complete barrenness is the result. This we have frequently observed to occur from land being trampled by sheep in eating turnips from strong clay soils during wet weather."

Baron Liebig, Sir Humphrey Davy, Johnston, Rodgers, and a host of others, bear testimony to the same facts. What do men plow and drain for but to make the soil more loose and porous?

But the second part of the proposition, that some soils are too loose and porous, seems to have created most surprise and indignation on the part of one member of the committee. He said: "There is no such soil in Missouri, and but little such anywhere."

This objection fully admits the truth of my remark, which he elsewhere calls monstrous; for, if there is, anywhere, such a soil, as he admits there is—then my statement is absolutely true and needs no explanation or modification, since I was speaking of the *physical structure of soils in general;* not of those in Missouri, as any one will see who will notice the connection of my remarks. I not only do not say this of the Missouri soils, but in the very next paragraph and in bold contrast to it, I say, "But the physical structure of the soil and subsoil of your part of the State, has no parallel, save perhaps in the valley of the Rhine, so famous for its fruit culture."

What could I say more, in an article on the adaptation of the soil of that district to fruit culture?

Again he is reported as saying, "The idea that soil (not sand) can be lixiviated or exhausted by leaching as ashes. * * He regards *as a monstrous doctrine.*"

Nevertheless, it is true of some soils, as he had already admitted, as shown above, and whatever is true of a soil cannot be very properly called a monstrous doctrine. If I have read correctly this very fact has been known and recognized by the very best writers on soils for the last two thousand years.

Virgil gives directions for leaching soils to determine their properties by testing the ingredients leached out, by the water which had percolated through it. All chemists, who make thorough analyses of soils, do the same thing. They determine the materials soluble in water as the plant food there available in the soil.

Johnston (I. F. W.), who, I hope is considered good authority, attributes the fact that soils contain so little saline matter, to this very "monstrous" doctrine, he says: "This I have attributed to the action of the rains, which dissolve out the soluble saline matter from the surface soil, and as they sink, carry it with them into the subsoil, or from sloping grounds, and during very heavy rains, partly wash it into brooks."

Morton also says, "the latter is so porous and loose in its texture that the rain and dews no sooner fall on it than they pass through it rapidly, like water through a sieve."

Dr. Rodgers, in his Scientific Agriculture, says, speaking of lime in soils: "A portion is also carried away in solution with the water which falls by rain and filters through both the surface and subsoil."

Whitley, in his Agricultural Geology, on the subject of soils not benefited by subsoiling, says: "When the soil and subsoil are both formed of loose materials, and the water sinks rapidly through them." Again he says, "Mineral manure is rendered soluble * * * but a portion of it also sinks into the subsoil."

Stephens, in his Book of the Farm, when speaking of the retentive powers of soils says: "The advantage of this is, that when soluble organic matter is applied to the soil, *it does not all soak through* with the water and escape beyond the reach of the roots of the plants."

But a book could be filled on this subject. I have quoted the best of the ancient authorities and the best of the modern.

But it is a fact that water will dissolve the plant food in a soil or the plant could never take it up by the roots.

It is a fact that water will percolate through some soils, else what the use of underdraining? It follows, therefore, that the water that passes through the soil must carry off some of the plant food, unless the subsoil be of a nature to absorb it and thus purify the water. The capacity of soils to hold water without permitting any to pass through and leach the soil, is as follows, according to Scheibler and

Johnston: "Thus from 100 pounds of dry soil, water will begin to drop (leach), if it be a

Quartz sand, when it has absorbed about			25 pounds.
Calcareous sand	"	"	29 "
Loamy soil	"	"	40 "
English chalk	"	"	45 "
Clay loam	"	"	50 "
Pure clay	"	"	70 "

It is found that good arable soils will hold from forty to seventy per cent. of water before it begins to leach.

When the soil leaches more readily than this the Germans turn it over to pine plantations, as the pines will send their long tap-roots down deep for the plant food leached from the soil and absorbed by the subsoil from the percolating water.

In this the Germans imitate the God of nature, who has planted the pine on similar soils in Missouri, and the Carolinas, and in New York and other States.

Prof. Emmons mentions a class of porous soils which he calls "leachy," because they have this very property, as this term is common in some parts of the Eastern States for very porous soils.

If my doctrine is monstrous, then Virgil was the father of monstrosities, Johnston fostered them, Emmons and a hundred others believed in them, the Germans thrive on them, and nature itself is monstrous.

Hard pan, so common under pervious gravelly soils long cultivated, is the result of this very property of the soil. Water percolating through the soil dissolves oxide of iron, lime, soda, potassa, alumina and sulphuric acid, which are absorbed as the water passes through the sand and gravel below, and form a cement that makes, with the sand and gravel, a solid and almost impervious stratum, called hard pan.

Stephens shows that in some drained lands forty-two per cent. of the rain-fall filters through the soil into the drains; and the *Scottish Farmer* for 1850 shows that water from the drains, after heavy rains, carries off as much as twelve per cent. solid matter from the soil drained, when the water filtered contains only four per cent. This looks a little as if soils were leached in that country.

But the experiments of Prof. Way, of London, are absolutely conclusive on this subject. They prove that clayey soils do retain a limited amount of alkalies, and so fix them up to a certain limit, that very little is lost by evaporation or filtration. They also prove that lime and all excess of alkalies may be carried off by filtration. He says:* "Clay has been shown to be the active substance in retaining manure, and sandy and gravelly soils not possessing a sufficiency of clay, will be expected to be less retentive of manure. Such is the fact; and soils of this description are said not to hold manure."

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* Journal of the Agricultural Society of England.

But I need not take up more of your space to prove a principle so well established and so generally recognized by agricultural writers.

G. C. SWALLOW.

FRUITS ON EXHIBITION.

The following report was read from the Committee on Fruits, and adopted:

Exhibited by G. S. Park, of Parkville, Mo.—Long Island Russett, only good; Willow Twig, fair specimens; Wine Sap, fair specimens; Winter May, quality second rate; Gen. Lyon, quality rather poor, apparently a late keeper, said to be seedling of Ben Davis, and same as exhibited last year at St. Louis as Good Year; Honey Sweet, over ripe, quality fair; Wine Apple, incorrect and name unknown; Dominie, fair specimens, in good condition; Virginia Greening, good specimens, in good condition; Fall Pippin, incorrect and decided to be Gloramundi; Little Romanite, good specimens and in good condition; Sweet Vandever, small, quality good; Winter Greening, small and of poor quality; Yellow Belleflower, good specimens; Janeton Red, are Rawles' Janet, ordinary specimens; Rome Beauty, incorrect, unknown, quality poor; Rambo, one specimen correct, the others incorrect.

By Mr. Charles Buckley, Hannibal, Missouri.—White Winter Pearmain, quality good; Rawles' Janet, fine specimens; Golden Pippin, decided to be incorrect, and identical with Ortley or White Belleflower.

By Thomas R. Allen, Allenton, Missouri.—Smith's Cider, good specimens; Winesap, large, fine specimens; Janeton or Rawles' Janet, fair specimens.

By Wm. Stark, Louisiana, Missouri.—McAfee's Nonsuch, fair specimens.

By Jeptha Todd, St. Joseph, Missouri.—Rawles' Janet, fine specimens; Missouri Red, a new seedling, fine size, quality fair, good keeper; Striped Pearmain, specimens fair. The committee were divided as to whether these specimens were identical with the McAfee Nonsuch, on exhibition.

By James A. Storm, fruit dealer, St. Joseph, Mo.—About thirty varieties, some of which are unknown. Among the known varieties are the following: Rawles' Janet, Smith's Cider, Pound Sweet, Baldwin, Esopus Spitzenburg, King of Tompkins County, Father Abraham, Lady Finger, Roxbury Russett, Yellow Belleflower, Northern Spy, Red Pearmain, Red Canada, Herefordshire Pearmain, White

Winter Pearmain, Ortley and Wine Sap. Many of the above specimens were of fair quality, and some of them very good.

All of which is respectfully submitted by your committee.

WM. STARK,
L. J. MUNGER,
WM. HOWSLEY,
JACOB MADINGER.

SUPPLEMENTAL REPORT ON FRUITS.

By Stewart & Humphrey, Macon, Missouri.—Wine Sap, fair specimens; Rawles' Janet, fair specimens; Ben Davis, fair specimens; and also a sample of two year old nursery trees of the following varieties: Rambo, Red Astrachan, Early Harvest, Wine Sap, Ben Davis, Rawles' Janet, Red June, and Maiden's Blush.

VEGETABLES.

The Committee on Vegetables on Exhibition, reported as follows:

H. M. & A. H. Vories.—Very good peachblow potatoes; showed signs of exposure to the sun and light. A specimen of very large beet, supposed to be mangel-wurzel. Some specimens of very long parsnips and carrots, showing good culture. Mammoth sweet potatoes and yams, showing culture and soil suitable. Fine specimen of celery, partly bleached; very fine. Pumpkins, two varieties; very good. One variety of long winter squash; good.

S. F. TAFT,
BENJ. L. STEPHENS,
GEO. S. PARK,
Committee.

Recess till 7 P. M.

EVENING SESSION.

Professor Riley delivered an interesting lecture on Practical Entomology, which will be found in his State Report in this volume.

Judge Montague moved a vote of thanks to Prof. Riley for his address, which was adopted.

THE PEACH BORER.

By special request, Prof. Riley gave some information on the peach-borer, an insect which is very destructive to the peach. It is produced by a moth, the larvæ of which does not mind the soap.

Mounding around the butt of the tree is a remedy which prevents the moth from laying its eggs at the base of the trunk. But the mound should be leveled down early in the spring, and rebuilt about the first of May.

Prof. Riley returned his acknowledgments for the honor conferred by Judge Montague's motion. He had only done his duty in a partial way, as required of him. He was young and had a life before him, but he found that the science in which he was engaged was more pleasant than profitable.

Mr. Vories asked Professor Riley if there was any hope of parasites ever destroying these fruit insects, as had happened to the grasshopper.

Mr. Riley could not encourage any hope of this. The grasshopper comes down from the Rocky Mountains, and will not survive here long enough to produce more than one generation. It deposits its eggs in the soil about two inches deep. The only remedy suggested was the destruction of these eggs. In France premiums were given, at so much per bushel, for the destruction of grasshopper eggs.

LETTER FROM HON. GEO. HUSMANN.

The President read the following letter from Hon. George Husmann:

BLUFFTON, MO., NOV. 28, 1870.

Dr. H. Clagett, President Missouri State Horticultural Society:

DEAR SIR: I regret exceedingly that it is not in my power to attend the meeting of the Society this week. The annual meeting of the Bluffton Wine Company, whose President I am, takes place this week, and urgent business compels me to be present. I regret this all the more, as this will be the first meeting of your society since its formation, that I have not attended, and it would be very pleasant to me indeed, to meet with its members at a place containing so many distinguished horticulturists and personal friends.

Hoping that the meeting will be well attended, and be profitable to all, I remain,

Yours, very respectfully,
GEORGE HUSMANN.

FOURTH AND LAST DAY.

After prayer by Mr. Murtfeldt, a discussion ensued on the propriety, hereafter, of interspersing the proceedings of the society's meetings with music, and it was agreed that arrangements should be entered into for that purpose.

Mr. Muir referred to the happy effects that resulted from the introduction of music in the Farmer's Institute at Manhattan, Kansas.

FLORICULTURE.

The following essay sent by Mr. M. G. Kern, of St. Louis, with a beautiful bouquet, was read before the Missouri State Horticultural Society:

Horticultural Societies, like all other sublunary institutions, are subject to change. The prevailing ideas of the day, success or failure in the production of remunerative crops, and the progressive character of their leaders and active members, alter their aims and purposes, and naturally divide their history into various and distinct epochs.

Certain fruits and crops have had their day, of long or short duration, according to their value in the market. Considering the proverbial excitability of the people of so progressive a country as ours, it is not to be wondered at that horticultural matters generally are taken as by storm in feverish excitement. Will any one, who has watched the history of Western horticulture for the last twenty years or more, deny that we have ridden many a pomological velocipede to our heart's content? How many of these have proved a blessing? How many a deception and delusion?

In later years we started with a will to worship at the throne of Bacchus.

All horticultural interests seemed for a time to sit triumphantly astride a ponderous polished wine cask.

But, lo! the elephant, too fond of costly sugars, does not seem to move quite fast enough to suit the taste and pocket of many an enthusiastic worker.

With the markets of the cities glutted with fruits in their season; with low prices realized (most generally absorbed to balance an account of untold expenses); with native wines begging in the market for thirsty souls to buy them, and with a world of destructive insect enemies to prey upon our efforts—shall we still hold on to the mistaken notion that horticulture means fruit, and fruit alone, mixed up of late with cords of entomological wisdom? Is this forever to be the theme of our friendly, yearly reunions? Shall we not hear one kind word on this occasion for flowers, shady groves and pleasant lawns, surrounding the almost numberless Western homes, already made and yet to be? for the things in horticulture that speak to the mind and soul of man and not alone to his purse and stomach.

The friends assembled on this occasion in the romantic, beautiful city of St. Joseph, have traveled from near and far, through a country unequaled on the globe in fruitfulness and charming scenery. Dull, indeed, must that man be called who cannot feel a thrill of joy and admiration when riding over these almost endless, fertile, ever-changing, waving prairies. Is there not a world of beauty in such an array of Western scenery? Shall we attempt to describe this beau ideal—this smiling face of mother earth? We have not words to do so; it is, indeed, something diviner than mere language can portray.

Realize the principle of charm and beauty; observe the points that impart most pleasure to your mind, and you have the key-note of the art to improve and to adorn the grounds that may surround your home; you comprehend the principle of landscape gardening. Behold the charming clearness of a distant prairie view; this will forever banish those piles of ash-heaps and of rubbish so often found in the most conspicuous surroundings of but too many a country dwelling. The lofty grove of shade trees, so pleasant to the sunburnt traveler, near your home, will surely thank you for this kindness. In so doing, you imitate the pleasing, graceful undulations on your lawn; you plant and rear your groups of flowers according to the patterns of graceful nature. This done, your home will surely have some traits of beauty and refinement, will please you better than before, and be far more endeared to your children.

Volumes have been written on the art of landscape gardening. Their fundamental all-pervading idea is the same. But few have ever given this branch of horticulture a serious thought. Its principles rightly understood, almost every one can do his share to its advancement. The numerous homesteads which dot these prairies, would then be in pleasing unison with their surroundings.

Intelligent and refined horticulture would thus become a boon and blessing to our people, not measured by the bushel or the gallon; its prize will be advancement of the race and true nobility of man.

Will our horticultural friends believe this, and think of it, when a smiling scenery again greets their eyes? We almost fear that some will shake their heads and doubt it all in toto. We confidently hope the rising horticultural generation will think differently on this subject. Yes, many a shaggy peach tree or hateful brier bush will yet make room for the lofty shade tree, the pine and the fragrant rose. The future of Western horticulture can easily be read by the signs of a progressive present. May we hope that the Missouri State Horticultural Society will extend the hand of friendship to her much neglected step children, landscape gardening and horticulture, and kindly accept of the small offering of flowers presented respectfully by

M. G. KERN.

THE BOUQUET.

Mr. Muir raised the question as to what should be done with the bouquet sent by Mr. Kern.

After some compliments to the *Morning Herald* and its reports of the Society's proceedings, he moved the presentation of the bouquet to the reporter of that paper.

Judge Montague responded on behalf of the *Herald* and its reporter.

Mr. Muir's motion was adopted.

Dr. Spalding made a fine tribute to the daily press for its dissemination of the proceedings of Horticultural Societies, which has contributed more than any other character of publication to the furtherance of the cause of agriculture and horticulture. He was very sorry there was but one newspaper in the city which had thought the meetings of this Society of sufficient importance to make any comprehensive report of the proceedings; but he would say that the *Herald* had compensated, by its fullness of reports, for any lack of attention in other quarters. Dr. Spalding offered the following resolution, which was adopted:

Resolved, That the thanks of this Society are due, and are hereby tendered to Mr. W. A. Thompson, the faithful and industrious representative of the St. Joseph *Herald*, for the comprehensive and correct reports which he has made of the proceedings and discussions of this Society during its sessions in this city; and also to the enterprising proprietors of the *Herald* for the liberal space they have given in their paper of his reports.

LANDSCAPE GARDENING.

Mr. Peabody spoke of the circumscribed interest in the proceedings of Horticultural Societies in general, but hoped for better things in future. He hoped that the subject of landscape gardening would be prominently brought forward at the next meeting by the submission of short essays and designs upon this theme. He favored the offering of premiums for bouquets to ornament the hall in which meetings were held. Nothing had so touched the whole chord of feeling among the members at this meeting as this beautiful bouquet sent here by Mr. Kern. He wanted to see the Beautiful as well as the Useful fostered. The encouragement of wine culture was calculated to do much good—the cause of temperance was to be helped by it. He did not want to see the pumpkins, the squashes, the potatoes and cabbage, shut out from consideration by the Society. But the encouragement of these affairs should not cause us to ignore flowers and ornamental development. He had endeavored to make this department a more prominent feature of consideration in our meetings. Mr. Peabody urged and believed that unless we come to a proper appreciation of the beautiful—to the encouragement of floral culture and landscape gardening—a blight, worse than the pear-blight, would fall upon this Society.

Mr. Wright coincided in these views, and indulged a compliment to Mr. Riley on the latter's excellent address, which he favored the Society with last night. Mr. Wright had never before listened to a scientific address so free from technicalities. Mr. Riley used the plain English in his speech, while omitting nothing that was valuable.

Mr. Murtfeldt paid a just compliment to Mr. Riley, whom he was intimately associated with. Mr. Riley was an indefatigable worker and an enthusiast in his calling. He is an artist in every sense of the word, and makes the drawings for his own reports. As our State Etomologist, his services were invaluable to Missouri. His cabinet is full of many thousands of insects, all well classified, bred by him from the eggs and carefully observed through all the changes of their existence, of which he can give illustrations. His rooms in St. Louis are daily visited by ladies and gentlemen, examining his specimens, which awaken interest in the science of entomology.

Dr. Spalding spoke of the training and beautifying of forest trees and their relation to landscape gardening. More than a year ago he took some of these trees in hand, and, having previously experimented, pruned them in the latter part of summer. He had succeeded in training an unsightly oak and making it into the shape of a pyramid. He advised pruning in the latter part of July. He had carried his experiments with pruning so far as to change the form of an oak from an upright pyramid to an inverted pyramid in *one year*. The Doctor referred to the difficulties that had been overcome by landscape gardeners, by whose experience we could profit; and if we would take advantage of the knowledge attained, surround ourselves with beautiful homes.

Mr. A. H. Vories was pleased with the proceedings and remarks proceeding from the little bouquet sent up by Mr. Kern, and agreed with every sentiment of encouragement of floriculture. The love of flowers was a universal feeling; the heart of the veriest savage could be softened by the gift of flowers. Wherever you see flowers growing, you may be assured there is refinement. The educated florist could go into his garden and tell the time of day by the flowers; and the pleasures of floriculture were almost illimitable in their variety. We should encourage its display at the meetings of this Society, in the interest of the ladies. If we had a fine floral display here, there would have been more ladies in attendance upon these meetings.

Judge Bliss related an anecdote illustrative of the influence of flowers. A young man who, sick in Sioux City—on his death bed—was presented with a bouquet, and as long as life lasted, he would not permit any one to go between him and that bunch of flowers. The last glance of his death-glazing eye was given to the bouquet.

RESOLUTIONS.

Mr. Peabody, of the Committee on Final Resolutions, submitted the following, which were adopted:

Resolved, That we hereby express our grateful thanks to the North Missouri, Hannibal and St. Joseph and Missouri Pacific railroads for returning our delegations over their lines free to their homes. We recognize in this spirit of liberality not only favors bestowed upon members of our Society personally, but also upon the cause of horticulture in the State.

Resolved, That the thanks of this Society are hereby cordially extended to the citizens of St. Joseph, and especially to the members of the St. Joseph Horticultural Society, for the kindness, hospitality, and the good will with which we have been received.

AGRICULTURAL COLLEGE.

Judge Bliss made some remaks about the State Agricultural College, the difficulties before it, and the necessity of every friend of horticulture and agriculture doing everything possible to foster and further its interests. He believed that the management of that institution should be under the control of a man who, while being scientific, should yet be a thoroughly practical agriculturist and horticulturist. He did not know personally of any one so qualified; but he believed the College was not so managed at present.

Dr. Spalding was glad to hear such expressions of interest on this important subject from such a distinguished source. Dr. S. was grieved to see that the Missouri Agricultural College was proceeding in the same course in which other colleges had failed.

Mr. Murtfeldt spoke of the mode of appointing Curators, and, agreeing with Dr. Spalding, deplored the course adopted as calculated to retard the influence and good results of the State Agricultural College.

Dr. Spalding thought that political influence was too potent in the selection of the Curators and managers.

Judge Bliss feared the Board of Curators were not politicians.

Dr. Spalding suggested this Society should have some voice in the selection of these Curators, as in Illinois.

Mr. Murtfeldt stated that each president of county and district agricultural societies in the State had a voice in the election of charter members of the State Board of Agriculture, but they had not attended the meetings so as to make their influence felt.

Mr. Muir said that at the very first organization of the State Board of Agriculture, this Society and all of the numerous horticultural societies of the State were deliberately excluded from any representation. It was an insult deliberately committed in the organic act, and continued till now. Many of the members of the board felt the injustice and wished to see this state of things changed. Although the Board originated in the action of horticultural societies, they had no voice in it. The Agricultural and Mechanical Association of St. Louis, notwithstanding its great wealth and wide-spread influence, was unrepresented in the State Board of Agriculture. Mr. Muir offered a resolution that the time has come when the State Horticultural Society should have a representation in the State Board of Agriculture.

Dr. Spalding objected. The Society did not want a representation. When it wanted it, it could get it, He did not want this Society to beg for a representation anywhere.

Mr. Peabody had understood that there was some merely personal matter connected with this question of representation, but thought there was no difficulty about their Society being represented in the Board.

Judge Montague warned the St. Louis members that one of our St. Joseph long speech-makers had returned from Kansas this morning, and if they did not mind he would get him on the floor, and if he *did* get there he would be speaking when the St. Louis men got home. (Laughter.)

After further discussion, the resolution of Mr. Muir was adopted.

PRESIDENT'S ADDRESS.

The following was submitted and adopted:

Mr. President: The committee to whom was referred the President's address, beg leave to report that they have had the same under consideration, and find the true spirit of horticulture pervading the entire address, by which we understand charity for all, and enmity toward none, or the greatest good to the greatest number. In the absence of specific recommendations we would call especial attention to the President's allusions to co-operation on the part of members with committees, "each in his favorite specialty, in collecting facts to report at our next meeting." The sentiments of this address commend themselves to every true horticulturist.

T. R. ALLEN.
E. J. MONTAGUE.
C. H. MANSUR.

November 30, 1870.

REPORT ON FLOWERS.

The following report on flowers on exhibition was received and adopted:

The Committee on Flowers have discharged the duty imposed upon them, and beg leave to report that there were on the table, exhibited by Mrs. J. W. Bailey, the following plants and flowers:

Vinca Variegated, Hedra Helix, Heliotrope, Primula Chinensis, Lycopodiums, two pots, Zonale Geraniums, two pots, Suphrano Rose in full bloom, Viola Napolitan in full bloom, Solanum Jasminoides, Calla Aethiopica, Ageratum Mexicanium, Geranium Roseum, Lobelia Erinus, Achyranthus Aureus.

The last two plants have been known to some of the members under the generic name of Coleus.

All of which is respectfully submitted,

JOHN H. TICE, *Chairman.*

Judge Montague offered the following resolutions, which were adopted:

Resolved, That the Missouri State Horticultural Society tender cordial thanks to Mrs. J. W. Bailey, Mrs. Wildbahn and Mrs. Hamilton for the handsome display of beautiful and rare plants and flowers kindly tendered for the ornamentation of this hall during our present session.

Resolved, That the thanks of the Missouri State Horticultural Society are due, and are hereby tendered to Dr. H. Clagett, our retiring President, for the efficient and courteous discharge of his official duties as the presiding officer of the Society, and for the earnest zeal displayed by him in promoting the interests of horticulture.

The following, offered by Mr. J. P. Humphries, was adopted:

Resolved, That the tenor of Mr. Allen's essay (viz., the upward and onward elevation of Horticulture) is expressive of the sense of this meeting, and that our object should be to cultivate finally, in the highest attainments, mentally, theoretically and agriculturally in the pursuit of Horticulture; that it is the business of the country, *the bone and sinew*, so to speak, and all our objects should be to impart the spirit of the essay.

The Society then adjourned to meet in Kansas City on the 11th of January, 1872.

WILLIAM MUIR, *Secretary*.

THE APPLE ORCHARD

BY WALLACE SIGERSON, ST. LOUIS.

The following directions, if carefully attended to, will insure complete success in growing an apple orchard.

The number of trees or acres embraced in our plan for the apple orchard, is not a matter of so much importance as the particular manner of preparation of the soil, and the planting and cultivating of the trees thereafter.

Observation demonstrates clearly the fact that there is not one first-class apple orchard in the country. The result is that universal disappointment prevails among those who have engaged in growing the king of all fruit.

For illustration, our orchard shall contain from ten to one hundred acres, as circumstances shall determine. The selection of the location will exert more or less influence on the successful results, when profit is a primary consideration; therefore we recommend the highest ground in the particular locality, or the bank of the Missouri or

Mississippi rivers. The immediate border of any considerable lake will do equally as well.

The land must be broke not less than twenty-four inches deep, which can be done with a plow and sub-soil plow at a moderate expense. When the sub-soil is not sufficiently porous, the entire plat for our orchard must be completely under-drained with tile. The drains must be so close to each other that the most complete and thorough drainage will be insured.

I recommend only the very best trees, three years old, from the bud or graft. Plant thirty-five feet apart, after the ground has been put in the most complete cultivation; set the trees as near the surface as the circumstances will admit. If necessary, stake each tree to hold it in an upright position. The uniform formation of the head should be carefully observed, in order to give symmetry and convenience to the orchard. I recommend that the lower limbs should not be nearer than six feet from the ground. The lower branches of the tree should be above the team with which we cultivate the orchard.

If you plant only the most sound and healthy trees, and the ground is prepared as we have suggested, there will not be one failure to live.

The trees must be washed with strong soap suds, soft soap or weak alkali, from the ground to the limbs, commencing with the first of May, and the washing to be repeated three or four times, at intervals of one month apart. The washing and scrubbing process must be continued year after year, or as long as it exerts a healthy influence on the tree.

The trees must be wrapped with straw, commencing at the surface of the ground and up into the first limbs. The wrapping must done in November, and the straw can be removed after the hard frosts are past in the spring.

We now come to pruning, which must be done sparingly, in fact exercise care in pruning, as understood by many orchardists, we positively prohibit. Trim only enough to admit the light of the sun and a free circulation of the atmosphere.

The ground can be cultivated in corn, potatoes or vines for the first five years after the trees are planted without disadvantage. If in corn, we recommend, indeed insist, that it shall be hogged off. The fertility of the soil must be maintained and kept up equal to its virgin condition. After the trees have attained a size when it will be no longer profitable to cultivate in corn, then red clover must take its place. The clover will make pasturage for hogs, whose presence are wanted in the orchard to assist in destroying the curculio and other enemies of the insect tribe which prey on the apple tree and its fruit.

The orchard shall be grounds frequented by all the poultry that can be maintained to advantage on the farm. Our plan contemplates a warfare on all the insects that are the destroyer of the apple tree and its fruit.

The tree must be well mulched every fall with tree leaves and sand. If tree leaves cannot be had then use straw. The mulching can be forked into the ground in the spring. The sand will add much to the fertility of the soil by keeping the ground in a pliable condition and admit the action of the atmosphere. Lime is essential to the perfect growth and development of the tree. The fruit will be much improved by the presence of lime. The amount of lime to be used will only be limited in proportion to the benefits derived. The last and not least in the list of our instructions which we insist must be followed to the letter, is the planting of a border of trees on the four sides of the orchard for a protection against the winds in both winter and summer. The first line of defense shall be a red cedar hedge. Outside of the hedge there must be a border of trees four rods wide. The Norway Spruce and White Pine can be grown successfully, and to great profit. The border of trees will afford fine protection both summer and winter for numerous insectiverous birds, who will aid in the destruction of the insects referred to. The ground must be prepared as for the apple orchard, which will insure an immese growth. If all our instructions are followed, we shall have apples enough the fifth year to pay expenses. From this time the increase will be rapid. By the time our tree are planted ten years, their will be twenty bushels to the tree. Twelve years planted, and we will have thirty-five bushels to the tree. The value of one acre will not be less than one thousand dollars. In addition to large crops the quality of the apples will be superior to any grown on the imperfect management of orchards throughout the country. Our plan of an orchard contemplates a considerable outlay at the commencement. A careful examination will demonstrate that no better investment can be made. One hundred acres will produce $100,000 worth of apples yearly from the time the trees are twelve years old until they are thirty years old. The plan above can be limited to any number of acres.

In conclusion, I remark that no weeds or grass must be permitted to grow in the orchard except red clover. The following list of apples can be recommended for this latitude in their order: Early harvest—Red Astrachan. Fall—Pennsylvania Redstreak. Early winter—Yellow and White Belleflower. Winter—Green Newtown Pippin, Rawles' Janet, Winesap, Pennock's Red Winter, Rome Beauty, and Ben Davis. For family use, leaving profit out of the question, I would plant Northern Spy, Esopus Spitzenburg, White Winter Pearmain and the Jonathan. The paper submitted is my own, without consulting any author, or adopting the opinions of any man. If my instructions are followed, the more complete success will be the result.

MEMBERS OF MISSOURI STATE HORTICULTURAL SOCIETY FOR 1871.

LIFE MEMBERS.

Henry T. Mudd, St. Louis.
A. E. Trabue, Hannibal.
J. H. Tice, St. Louis.
H. Clagett, Gray's Summit.
Chas. Peabody, Glenwood.

ANNUAL MEMBERS.

Dr. B. H. Stephens, Brighton, Missouri.
T. W. Guy, Glenwood, “
O. H. P. Lear, Hannibal, “
C. H. Mansur, Chillicothe, “
John Logan, St. Joseph, “
James Roberts, “ “
J. C. Parker, “ “
A. H. Vories, “ “
L. G. Munger, “ “
E. J. Montague “ “
H. R. W. Hartwig, “ “
Levi C. Clark, “ “
Jacob Medinger, “ “
A. J. Sheffield, “ “
D. M. Richards, “ “
Alexander Reeder, “ “
Chas. Whiting, Kansas City, “
J. F. Taft, Hannibal, “
Wm. Stark, Louisiana, “
C. W. Spalding, St. Louis, “
F. F. Fine, Springfield, “
Joseph L, Vorman, Kansas City, “
O. S. Rathbon, St. Joseph, “
—— Miles, Gray's Summit, “
Z. S. Ragan, Independence, “
Daniel J. Hubbard, St. Joseph, “
A. Patee, St. Joseph, “
R. J. Lewis, Westport, “
R. L. Hall, Kansas City, “
L. W. Worthington, St. Joseph, “
P. Bliss, St. Joseph, “
U. P. Bennett, Independence, “
Jeptha Todd, St. Joseph, “
Jas. D. Medor, Independence; “

J. P. Reichard, St. Joseph,	Missouri.
Stewart V. Humphries, Macon City,	"
C. W. Hogan, Salisbury,	"
Thos. H. Davis, St. Joseph,	"
O. P. Moran, Converse,	"
J. M. Beecher, Kansas City,	"
Wm. Muir, St. Louis,	"
James H. Storm, St. Joseph,	"

TRANSACTIONS

OF

MISSISSIPPI VALLEY GRAPE GROWERS' ASSOCIATION FOR 1871.

OFFICERS.

PRESIDENT.
DR. L. D. MORSE.
VICE PRESIDENTS.
DR. E. S. HULL, H. J. COE.
SECRETARY.
WILLIAM MUIR.
TREASURER.
JOHN H. TICE.
BUSINESS COMMITTEE.
DRS. CLAGETT, SPALDING AND HULL.

MISSISSIPPI VALLEY GRAPE GROWERS' ASSOCIATION.

The spring session of this Association assembled in the large rooms of the Agricultural and Mechanical Association, most liberally given for the session, on the 6th inst., at 10 o'clock A. M. In the absence of President Starr, the chair was occupied by the Vice President, Mr. George Husmann, with Dr. L. D. Morse, Secretary.

The attendance was good, and the samples of wine on exhibition very numerons.

A letter from President Starr was read containing suggestions in regard to several points conducive to the welfare of the Society.

Colonel Colman moved to refer unfinished business referred to in the President's letter to a committee, and Messrs. Colman, Tice and Hull were appointed.

On motion, a committee on Terminology was appointed, consisting of Messrs. Spalding, Riehl and Engleman.

A motion was made to amend the constitution by abolishing the Executive Committee.

After some discussion, the matter of changes in the constitution was referred to a special committee, consisting of Messrs. Spalding, Colman and Clagett.

Mr. A. Engleman said he had a report on protection, but thought it had better be referred to another committee, and, on motion of Mr. Peabody, the matter was referred to a committee. Messrs. Krausnick, Spalding and Engleman were appointed.

A motion was made for the appointment of three committees on red and white and premium wines. Carried.

The premium competed for is one of $25 in trellis wire, offered by Ludlow, Saylor & Co., for the best six bottles of Concord wine of '69. It was made a rule that the committees should be selected by exhibitors.

Mr. Muir called attention to the fact that too many bottles (six) were required from the exhibitors.

It had too much of the appearance of a speculation. If the wine remaining over the exhibition became the property of the party offering the premium it could be made a profitable investment.

Dr. Morse explained that the gentlemen offering the premium wished the surplus wine to be used by the Society.

Mr. Muir gave notice of the following motion:

Resolved, That in future all premiums offered by or through this Society shall call for two bottles only.

Dr. Spalding said that he thought the white Concord should hereafter be classed with white wines, and he made such a motion.

Col. Colman said each variety ought to stand by itself.

Mr. Bush thought the best way was to classify by white and red wines.

Mr. Krausnick thought the wines should be classed by color; except Concord, which should be put in two classes.

Colonel Colman thought this was a very grave question, that if the entering wedge was made, there would be no knowing where it would end. He wanted all wines sold by their variety, as Concord, Catawba, etc.

Dr. Spalding said the sale of wines by name was a greater evil, as the poorest wines could thus be sold.

Mr. Squires thought wines should stand upon their own merits, whether mixed or not—the wines may be good, no matter of what grapes they are made.

Dr. Clagett thought the committee should be the same on both kinds of Concord wines, so that we can know which is the best.

The President, Mr. Husmann, said he thought as Dr. Clagett did, and he would state that he had red Concord which he thought better than white.

AFTERNOON SESSION.

Mr. Colman, of the Committee on Proposed Amendments to the Constitution, reported, recommending that article second be amended so as to read that the officers shall be a President, two Vice-Presidents, a Secretary and Treasurer, and that they be an executive committee; also, that the proposed amendment to change the Society's name to The St. Louis Grape Growers' Association, be indefinitely postponed.

The former recommendation was agreed to, and on the latter there was a spirited discussion. The change was urged on the ground that the present name was too extensive in its meaning for the actual work done, and resisted on the ground that the Association wished membership and co-operation without local restrictions.

The indefinite postponement prevailed.

The Secretary reported the following committees, chosen by the exhibitors:

White Wines—John M. Pearson, George Eisenmeyer, Dr. Hull.

Red Wines—Dr. Morse, N. J. Colman, Chas. Frings.

On Premium Wines—Messrs. Frings, Morse and Pearson.

Dr. Morse reported having seen Messrs. Ludlow, Saylor & Co., who said they would not object if the Society saw fit to admit exhibitors for the premium with but one or two bottles, but in that case the remaining four or five should afterwards be forwarded.

Dr. Clagett thought that in that case those who have brought six should be allowed to withdraw four or five.

It was agreed that competitors may submit one or two bottles, and afterwards forward the rest to the firm.

A discussion arose as to whether California wines could compete. It appeared that none had ever competed, but that they might be admitted—that there was nothing to exclude them.

The choice of officers was entered upon. After many balloting, Dr. L. D. Morse was elected President, receiving fourteen out of the twenty votes cast.

Dr. Hull was chosen First Vice-President.

Dr. H. J. Coe, Second Vice-President.

William Muir, Secretary.

John H. Tice, Treasurer.

A recess was taken, on motion, to enable additional wine committees to be appointed, it being considered that those previously appointed had more than they could attend to.

After the recess the following new committees were announced:

On Old Red Wines—Messrs. Husmann, Spalding and Paffrath.

Old White Wines—Messrs. Eisenmeyer, Krausnick and Muir.

On Dr. Clagett's motion, the subject of new grapes was taken up for discussion.

Mr. Pearson moved that the association recommend the Goethe grape, or Rogers' Hybrid No. 1. as a grape for white wine.

Dr. Spalding would add—and for market and table. He thought it had no superior for these. As a wine grape, the samples from it were excellent. There was but but one objection—the foliage was rather thin and weak. While there was nothing to substitute for the Goethe grape, he had a misgiving as to the durability of the foliage. The true and full test of any variety of grape is, its yield in a succession of years, and he feared the Goethe would not stand this test.

Dr. Hull inquired if Dr. S. indorsed the theory that when a plant has a spotted leaf it is in an inferior condition?

Dr. S. replied that he did.

Mr. Eisenmeyer asked if the wine from the Gœthe did not become foxy and aromatic?

Mr. Husmann said that at the Hermann Fair it was the best wine.

Dr. Hull asked Dr. Spalding if he had examined the leaf microscopically, and had thus determined that the leaf was not thick enough to resist the leaf-hopper?

Dr. S. answered that he had—that the insect pierced it.

Mr. Husmann found the Gœthe grapevine to be as healthy and hardy, and to have as good foliage as any. The specks on the leaf he thought no disease. There were three thousand of the Gœthe vines at Bluffton, and none had stood the test of the severe season better than they. At Hermann there was no trouble with it.

Dr. Hull knew no evidence of weakness but the color of the leaf; had seen it by the Delaware vine, and it remained secure while the latter was eaten up.

Dr. Spalding thought it could be easily over-cropped, and then would mildew and rot.

Mr. Bush had found that several vine-growers who had been most favorably impressed with the Gœthe at first, have now come to entertain doubts of it. The chairman's success might be credited to his unusually excellent treatment. It was found to have the foxy and aromatic taste already spoken of, though it might lose this. Yet it is a good market grape, brings a better price and bears later than the Concord, and yields immensely; is easily overcropped, being prolific to a fault.

The grape was further discussed by Messrs. Krausnick, Husmann, Bush, Hull, Spalding and others, and the No. 4, or Wilder grape, taken up. It was described as prolific at first, but liable to yield less, and of an inferior color and quality afterwards, and as ripening without its leaves.

Dr. Spalding thought it adapted to a more northern latitude than ours. Next to the Gœthe he had confidence in the Meramec, or No. 19. No. 4 had proved as defective in foliage as the rest.

Mr. Husmann had found the Wilder, Hybrid No. 4, never fail to yield a large crop of very excellent fruit; sometimes the leaves will fall, and again not, but the clusters ripen well. The vines grew strong after five or six years. He was not so well satisfied as to the wine-making quality of the grape, but prefers it to the Concord. One of the best was No. 3, Massasoit. This was early, prolific, of excellent quality, and made fine wine. He thought highly of the Lindley, or No. 9, but the last year it rotted or defoliated—though that was an exceptional year. He was not prepared to call it better than the Gœthe. No. 8 he thought had been overlooked. He had found it as valuable as the Gœthe; like it in color, but round, while the Gœthe is oblong. The Salem always suffered from rot or mildew, and though fine in quality he thought less of it than of the Meramec, No. 19.

The Maxatawney was very favorably spoken of. Quality best, a good but not rampant grower, and healthy.

SECOND DAY.

The meeting was called to order at 10 o'clock, Dr. Hull in the chair.

Mr. Engleman, from Committee on Protection, reported that the committee had agreed that a specific duty of fifty cents per gallon on foreign wines would be sufficient. The committee would write a memorial to Congress, and have it printed for the use of the members.

Dr. Spalding said the committee desired further time to prepare this memorial. The tariff question is now before Congress, and this subject may be reached at any time.

On motion, the committee was instructed to draft a memorial to Congress.

Mr. Muir offered a resolution that in future all premiums offered by the Association shall call for only two samples or bottles of wine.

Dr. Spalding proposed, as an amendment, the following:

Resolved, That in the future exhibitions of wine of this society, pint bottles are hereby recommended as the most convenient size, and two bottles of each sample as a sufficient number.

Mr. Muir's resolution was withdrawn, and Dr. Spalding's substitute was adopted.

Dr. Spalding, from the Committee on Terminology of the Vine, asked for further time, so many conflicting views existed on this subject that the committee desired to go over the whole ground, and would therefore ask time, so as to report at the next meeting. Granted.

AWARDS OF WINE COMMITTEES.

Dr. Morse reported that the committee had finished their report on red wines, and had awarded the premium of $25, for white Concord, to Dr. Clagett. The sample of A. F. Starr was nearly equal.

Concord—$25 Premium.

1. S. H. Long, Alton. 80.
2. J. Mallinkrodt. 75.
3. Dr. Clagett. 92⅓.
4. Cliff Cave Wine Company. 80.
5. Same. 75.
6. Augusta Wine Company. 85.
7. Bluffton Wine Company. 85.
8. A. F. Starr, Alton. 90.
9. C. Paffrath. 85.

Norton's Virginia.

1. Bluffton Wine Company. 76⅔.

2. Cliff Cave Wine Company.
3. E. Krausnick.
4. Golden Bluff Vineyard.
5. E. R. Mason.
6. Same. 80.
7. Dr. Clagett. 60.
8. E. A. Thompson.
9. A. Burtin. 65.
10. G. E. Eisenmeyer. 87⅔.

(Several bottles of this wine were broken before being examined by the Committee.)

Catawba.

1. E. Baxter, Nauvoo, Ill. Graded 83⅓.
2. A. Engleman, Shiloh, Ill. 1866, graded at 83.
3. " " 1867, " 84.
4. " " 1868, " 74.
5. Golden Bluff Vineyard. Graded at 73⅓.
6. " " " "
7. L. Winter, Belleville, Ill. Graded at 73⅓.
8. Julius Mallinckrodt.
9. Same.
10. A. Burtin, Nauvoo, Ill. Graded at 75.

Best Catawba by Golden Bluff Vineyard, entry 6.
Second best, Julius Mallinckrodt, entry 8.

Concord—(One bottle each).

1. A. & F. Starr, Alton, Ill., (white,) graded at 81½.
2. Same (red). 70.
3. J. J. Squires, DeSoto, Mo. 77⅔.
4. E. Baxter, Nauvoo, Ill. 75.
5. E. Krausnick, St. Louis. 61⅔.
6. Charles Braches. 76⅔.
7. A. Engleman. 71⅔.
8. E. A. Riehl, Alton, Ill. 60.
9. F. Will, Hopewell Furnace, Mo. 81⅔.
10. Golden Bluff Vineyard. 80.
11. Dr. Clagett. 70.
12. Louis Winter, St. Clair county, Ill. 63⅓.
13. E. A. Thompson, Cincinnati. 66⅔.
14. Bluffton Wine Company. 50.
15. George Eisenmeyer, Mascoutah, Ill.

Ives.

1. Bluffton Wine Company.

Iona.

1. Dr. Clagett, pronounced very good, rated at 75.

Taylor.

A. Engleman; graded at 80.

Delaware.

1. Golden Bluff Vineyard; graded at 80.
2. E. A. Thompson, Cincinnati; graded at 80.

Meramec.

E. A. Riehl, 70.

Wilder.

E. A. Riehl, 63⅓.

Goethe.

E. A. Riehl; graded at 62.

Cunningham.

1. A. Engleman. Pronounced very good; graded at 86.
2. Same. Graded at 80.

Rentz.

Cliff Cave Wine Company, 80.

Hartford Prolific.

1. Cliff Cave Wine Company; graded at 78⅓.
2. Bluffton Wine Company; graded at 65.

Norton's Virginia.

1. Bluffton Wine Company.
2. Cliff Cave Wine Company.
3. E. Krausnick.
4. Golden Bluff Vineyard.
5. E. R. Mason, 86⅔.
6. Same.
7. Dr. Clagett.
8. E. A. Thompson.
9. A. Burton, 66⅔.
10. G. E. Eisenmeyer.

Mixed Wines.

1. Charles Braches, Taylor and Goethe; graded 65.
2. A. Engleman, Norton and Clinton, 80.
3. E. A. Riehl, Norton, Cynthiana and Herbemont; 71⅓.
4. Louis Winter, Catawba and Concord; graded at 75.
5. Same, Clinton and Norton.
6. P. G. Edwards.
7. John Valle, Concord and Clinton.

Herbemont.

Louis Winter, very good; graded at 87.

Clinton.

1. E. Baxter; graded at 68⅓.
2. Golden Bluff Vineyard; 79.
3. E. R. Mason, (fermenting).
4. Do; 79⅓.

Dr. Clagett, as chairman of the committee on business, reported, as subjects for discussion: 1st. Preparation of the ground for planting. 2d. Distance apart at which to plant. 3d. Pruning and training the vine.

It was thought better to finish the subject of varieties, and Ives was proposed.

Mr. Husmann took the chair. He said that he had to tender an apology for the seeming rudeness with which he yesterday declined the honor of re-election to the chair.

It was with no design of offending the Society but he felt that while he might make an efficient worker in the vineyard or on the floor he was but a poor chairman.

He then introduced Dr. Morse, the new President, and expressed his belief that the association had in him a person eminently qualified to fill the chair.

Dr. Morse took the chair. He said that Mr. Husmann was the proper person to occupy that position as being at the head of the grape growers of the State in extent of vineyard and of practical experience. He would do to the best of his ability.

THE IVES.

Dr. Spalding spoke of the Ives, said it was preferable in quality to the Concord, and perhaps yielded as much to the acre. Last season was unfavorable to new varieties. He thought the Ives less liable to rot than the Concord, and this is one of the important advantages to be derived from planting this new variety.

Dr. Hull spoke favorably of the Ives, he had made the remark that he had never seen a rotten grape of this kind; since then his attention had been called to rotten Ives, and he had found the rot owing to the grape codling, and not to the grape rot.

Colonel Colman said there was another point connected with the Ives, which was, that on account of its late maturity it was excellent for shipping purposes. Its quality is not first rate—not so good as the Goethe. The Concord cannot be retained very long on the vines, and not good for shipping. The Ives does not come into bearing early, but age brings it out. (Dr. Spalding said it only required one year more). Colonel Colman thought it required more than a year. The vines are very cheap; he had never known any grape to come down so rapidly; you cannot sell them at thirty dollars per thousand. He wanted to know if there was a thick-skinned grape fit for shipping.

As our railroads are extending in all directions, it is important to us to ascertain the best shipping grape, and also the best packages. The Ives will hang upon the vines until frost comes.

The vine is very healthy in its foliage, and the wine is of a most desirable character.

Dr. Hull. As to the cheapness of the vines there is no doubt that arises from the fact that every eye will propagate a plant with but little trouble.

Mr. Husmann did not think the Ives should be recommended for everything. Late in the season it becomes so shriveled as to be unfit for shipping. While he commended the Ives, he thought we had other varieties that were preferable for late shipping. We should not do like the Cincinnatians, and overrate the Ives. We should not run the thing into the ground. The Goethe, the Wilder and Rogers No. 8, are better. We should not recommend a grape on account of the price.

Dr. Spalding said: Although he could not recommend the Ives as first rate, it was a good grape to raise on several accounts. While the quality is below the Concord and above the Hartford Prolific, it is the best we have. He knew of no grape to succeed the Concord (except the Goethe), but the Ives. It is the most reliable variety we have.

Mr. Eisenmeyer said he and his neighbors had concluded that the Ives had superseded the Concord as a wine grape. In bearing it is fully equal to the Concord. It is fully established at four years old. It is free from rot. One of the parties referred to had four thousand plants over four years old and several others had two thousand vines.

Mr. Stark, placed the Ives beyond the Concord as a healthy grape, hardy, holds its foliage very well. Concord had rotted twenty per cent. while the Ives had not lost a berry.

The Rentz.

Dr. Spalding called up the Rentz grape, which he had tested in the grape and in the wine. The wine is above the average of Concord. He regards it as a promising variety, both for still and sparkling wines. In productiveness and hardiness he classed it with the Ives. If you have good vines to start with, you have a small crop the third year and a prolific one the fourth. The unsightly appearance of the fruit renders it unfit for market, and it should be raised only for wine. It is a light red wine, and the sparkling Rentz is classed with the best samples of European champagne, and this is more than can be said of any other variety of American wine. He hoped the time would come when still wine will take the place of sparkling The foliage is thicker than any other variety. The skin is also very thick.

Mr. Husmann spoke of the sparkling Concord as superior to the sparkling Catawba.

Dr. Spalding said the merits of the Concord had been overlooked as a sparkling wine, but it was inferior to the Rentz.

Colonel Colman differed with Dr. Spalding in regard to the sparkling and still wines. The sparkling wines are the fashionable wines, and are used at every wedding and party. They are the wines that pay the largest profits. It is not every grape that will make sparkling wine. Grape-growers should cultivate that kind that will make the best sparkling wine.

The Telegraph.

Mr. Husmann said he would like to have the Telegraph or Christine brought up. The tendency just now is in favor of white wines, but if any new dark grape is worthy of attention it is this. It is very healthy; last year it had the healthiest foliage of 100 varieties. When the vine becomes about four years old it produces well, not large bunches, but three to four to a shoot. Colors about the time of the Hartford; berry about same size as Ives; bunch very compact, and generally shouldered. Samples of wine were very superior. It has a thinner skin than the Ives. Ripens about with the Hartford.

Martha.

Mr. Husmann has cultivated this variety longer than any other person in this State. It is productive, healthy and hardy. It was healthier last season than its parent.

Being a white grape it has an additional value in market. Superior as a wine grape to the Concord. It is a good deal superior to the Concord. In a fair season the *must* is ten per cent. higher than the Concord. Can always make a white wine of Martha, but everybody cannot make a white wine of the Concord. We allow the Martha to hang too long on the vine. By gathering them earlier they have more acid and less of the foxy aroma. The productiveness of the Martha is good—he had considered it too productive. The fruit should be thinned out and gathered early so as to have less of the foxy aroma.

In reply to the question as to how he made white Concord, Mr. Husmann said it was by gathering the grape early, and adding sugar to the must.

Dracut Amber.

Mr. Mason said the Concord and the Alvey deteriorated more rapidly than any other grapes. They should be gathered early. The Norton can remain on the vine as long as you please. He spoke of the Dracut Amber, which he fruited last season, and found the demand very great on account of the color and size. They are inferior to the Concord, but sell well. He had no doubt they would make a good wine. The vines are very healthy, and not subject to rot. The skin is very thick, and it will bear transportation.

Mr. Husmann said the Dracut Amber was very productive and healthy, but the quality is very poor—has the fox, tail and all.

Col. Colman said the Dracut Amber sold well on account of its color. It was used by putting the branches on top of others.

Cynthiana.

Mr. Riehl called up the Cynthiana, and spoke of it favorably.

Mr. Husmann said he had introduced the Cynthiana into the State, and had no hesitation in pronouncing it the best red wine grape we have. It is distinct from the Virginia Seedling. The wines cannot be mistaken, though the vines and fruits may be. It is sufficiently productive; he had never seen a rotten berry. It will no doubt supersede all other red wines in the market. It is very difficult to propagate, and is not generally disseminated. He wanted the question settled whether the Norton and Cynthiana are one and the same.

When the wine is made in sufficient quantities it will be superior to any of our wines.

Dr. Spalding said the berry of the Cynthiana is larger than the Norton, and there is a difference in the foliage; but the foliage had to be seen in quantity, or on the vine, not a single leaf only.

They are both wine grapes, and no one can have any doubt in regard to the wines. The advantage is in favor of the Cynthiana. It suits the American taste, or any refined taste, better.

Mr. Mason said he doubted that the varieties were distinct until he tested the wine.

The Walter.

This grape was pronounced a failure the last season.

Mr. Husmann said he had planted 500 vines of the Walter at Bluffton, for the purpose of testing it. The vines grew well until the wet weather set in, about the middle of June, and there was not a leaf left on the vines. Last season was very unfavorable, but he could not recommend it for extensive trial.

Dr. Spalding said he had better luck than Mr. Husmann. He had planted late, and there are several good buds above the ground. He would be glad to have the Walter succeed, on account of its fine appearance and superior quality.

Mr. Muir had planted a vine of the Walter and found it doing well.

Mr. Stark had planted two and a half dozen in June; in six weeks not a leaf was left, and he doubted whether one was alive now.

The Eumelan.

Dr. Spalding spoke of the Eumelan, which had succeeded well with him. He had seen the fruit on the Hudson, and the quality was good. He thought it worthy of trial. The foliage appears to be hybrid, and it was difficult to classify.

Mr. Riehl said he had tried it and it had done well.

TYING VINES.

Col. Colman brought up the subject of tying.

Mr. Husmann said the only thing fit to tie with is the willow. The golden willow is the best. No vineyard is complete without a growth of willows.

Dr. Spalding disagreed with Mr. Husmann, and said he had used twine. The common gunny bags unraveled made good ties, and they last through the season. A stronger twine is used in summer than in spring.

Dr. Clagett said if stakes were used, very strong tying is required; but on a trellis a slight tie will do. The bark of the pawpaw and the bass wood is good. Peel off the bark and rot it in a pond, and it peels off in ribbons and makes a beautiful tie.

Mr. Edwards said he had found that nothing but the willow would answer for tying to stakes, and he had tried gunny bags, twine and pawpaw and linn bark.

Mr. Squires spoke of a plant called the Yucca Fillamentosa which Prof. Shepard had recommended as the very thing that vineyardists want for tying.

AFTERNOON SESSION.

The Association met at two o'clock.

On motion of Dr. Spalding, a vote of thanks was tendered to the St. Louis Agricultural and Mechanical Association for the use of their rooms.

Prof. Riley, the State Entomologist, read an able and valuable paper on the new grape root borer.

Several gentlemen related their experience with the grape and apple borers.

Mr. Riley said it was dangerous to plant vines among stumps.

Mr. Muir said the same borers destroyed the vines in Kansas on the prairie lands many miles from timber.

Mr. Riley stated, in reply to a question, that the holes made in the young wood of the vine were made by the snowy cricket for depositing its eggs.

Mr. Muir said he had boiled his posts in coal tar, and had not found any borers among them. Those that were not boiled in coal tar were full of borers.

Mr. Riley said the beetles were attracted by a glaring light, and this might enable persons to destroy them.

Mr. Squires said last summer he was besieged by thousands of bugs of various kinds—some with legs and some without legs, and some with six wings.

Dr. Spalding spoke of the grape codling, that was quite destructive last summer. He wanted to know if there was any other insect that preyed upon it, and whether the wet season caused its increase.

Mr. Riley said he was unable to tell. The same parasite that attacks the vine attacks the codling. There is also a little white worm that destroys it.

Dr. Clagett presented samples of the White Missouri and Malvasia wine of 1863. These were made in California.

FALL MEETING.

Mr. Engleman moved that the fall meeting be on the second Wednesday in September, in St. Louis.

Dr. Spalding said the wines as well as the grapes would be exhibited there.

Mr. Engleman said as it was quite warm in September, he doubted whether wines could be exhibited to advantage, unless a spacious ice box can be obtained.

Dr. Clagett thought there should be but one meeting, and that held in the fall. He thought the officers should provide a refrigerator.

Dr. Spalding moved that wines and fruit be exhibited at that meeting. When the American Pomological Society met here last year, there was a large collection of wines, and there was no trouble with them.

The motion to have a fall meeting in September prevailed, and the meeting adjourned.

LIST OF MEMBERS OF MISSISSIPPI VALLEY GRAPE GROWERS' ASSOCIATION FOR 1871.

Dr. E. S. Hull, Alton, Illinois.
Chas. Peabody, Glenwood, Missouri.
C. W. Spalding, St. Louis, Missouri.
N. J. Colman, St. Louis, Missouri.
Isidor Bush, St. Louis, Missouri.
H. Clagett, Gray's Summit, Missouri.
J. H. Tice, St. Louis, Missouri.
J. M. Pearson, Godfrey, Illinois.
E. Krausnick, Centreton, Missouri.
Louis Winter, Lentzville, Illinois.
F. Starr, Alton, Illinois.
J. E. Starr, Elsa, Illinois.
J. J. Squires, DeSoto, Missouri.
R. J. Edwards, Hanover, Illinois.
George Husmann, Bluffton, Missouri.
Charles Paffrath, Melrose, Missouri.
G. B. Worthen, Warsaw, Illinois.
E. A. Riehl, Alton, Illinois.
A. Engleman, Shiloh, Illinois.
H. J. Coe, Staunton, Missouri.
E. R. Mason, Webster Groves, Missouri.
Dr. W. S. Dyer, Vineland, Missouri.
Geo. C. Eisenmeyer, Mascoutah, Illinois.
Wm. Muir, St. Louis, Missouri.

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ERRATA TO CORRESPONDING SECRETARY'S REPORT.

Page 35, 13th line from bottom, for "section" read "secretary."
Page 38, 4th line from bottom, for "prevented" read "protected."
Page 73, 6th line from bottom, for "affects" read "affect."
Page 79, 3d line from top, for "load" read "loads."
Page 79, 23d line, after "while" insert "there is."
Page 79, 7th line from bottom, for "constructive" read "prospective."
Page 98, in paragraph 12, for "transmit" read "transfer."
Page 98, 11th line from top, for "progress" read "process."
Page 101, 17th line from bottom, for "in fact" read "in part."

(3)

THIRD ANNUAL REPORT

ON THE

NOXIOUS,

BENEFICIAL AND OTHER

INSECTS,

OF THE

STATE OF MISSOURI,

MADE TO THE STATE BOARD OF AGRICULTURE, PURSUANT TO
AN APPROPRIATION FOR THIS PURPOSE FROM THE
LEGISLATURE OF THE STATE.

BY CHARLES V. RILEY,
State Entomologist.

JEFFERSON CITY, MO.:
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PREFACE.

To the Members of the Missouri State Board of Agriculture:

Gentlemen: I herewith submit for publication, my Third Annual Report on the Noxious, Beneficial and other Insects of the State of Missouri.

No particular action seems to have followed the suggestions thrown out in my last year's preface, as to the procuring of a better quality of paper and ink for these Reports. The impressions of the cuts which illustrate the text, are consequently quite inferior in my second Report, and fail to do justice to the engravings.

As will be seen from the following pages, many important discoveries in Economic Entomology have been made during the year, and some few insects have been very abundant. On the whole, however, we have enjoyed more than the usual immunity from insect depredations throughout the State. Complaints have been numerous, and articles giving extravagant accounts of the increase of noxious insects are continually appearing in our agricultural papers. But while some insects are on the increase, others are on the decrease, and the cause for alarm is in a great measure imaginary. More is now said and written about insects in the industrial journals of the State than formerly, because, through the agency of these Reports, the people have had their eyes opened to the importance of the subject; and the impression that insects generally are on the increase must be, in a great measure, attributed to this fact rather than to any real increase that has occurred.

The *American Entomologist*, in the columns of which some of the observations contained in this Report have already appeared, was continued during the year, and a botanical department, edited by Dr. George Vasey, of Normal, Illinois, was added to it. The charge of such a journal, together with my State duties, kept me too much confined, and for these and other reasons given, the magazine has been suspended during the coming year, 1871.

This suspension will enable me to spend more time in the field, and as these annual Reports have but a limited circulation, and as very many cultivators of the soil must in consequence, fail to get the information contained in them, I have concluded to devote more time the coming year to lecturing; and have already prepared for that purpose a number of large, colored illustrations.

I am satisfied that by this means I can materially add to the good effected by these Reports, and I shall endeavor to fill any engagements which the officers of our county agricultural and horticultural societies may desire to make, providing they give me notification a sufficient time beforehand.

In the following pages the same rules are complied with as were laid down in my first Report. When the insects treated of are new, or the existing descriptions of them are imperfect, or in a foreign language, I have added a full description, which is, however, always printed in smaller type, so that it can be skipped by the non-interested reader. The popular name of each insect is accompanied by the scientific name, and the latter is always printed in *italics* and mostly in parenthesis, so that it may be skipped by the practical man without interfering with the text. The Order and Family to which each insect belongs, is also given under each heading. The dimensions are expressed in inches and the fractional parts of an inch, and the sign ♂ wherever used, is an abbreviation for the word "male," the sign ♀ for "female," and the the sign ☿ for neuter. It must also be recollected that many of the figures are magnified, and that the hair line at the side of such gives the natural size.

The scientific reader will notice that some of the insects are referred to the old instead of the more modern genera, and this course has been pursued because the generic nomenclature is constantly changing, and because the old name has often become thoroughly associated with the insect in the mind of the practical man, who would be confused by, and is not interested in, the nice changes taking place in classification.

All the illustrations in this, as in the previous Reports, have been drawn from life by myself, or under my direct care, unless otherwise stated.

I have secured a pleasant office, connected with that of your Secretary, at Room 29, Insurance Building, Southeast corner of Fifth and Olive streets, St. Louis, and all letters sent to me should be thus addressed.

My acknowledgments are due to the Superintendents of the following railroads, for free passes over their respective routes: The Pacific Railroad of Missouri, Atlantic and Pacific, St. Louis and Iron Mountain, Hannibal and St. Joseph, North Missouri, Chicago and St. Louis, Illinois Central, and the Rockford, Rock Island and St. Louis.

All which is respectfully submitted by

CHARLES V. RILEY,
State Entomologist.

ST. LOUIS, MO., December 2, 1870.

NOXIOUS INSECTS.

SNOUT-BEETLES.

(Coleoptera Curculionidæ).

AN ACCOUNT OF SOME OF THOSE SPECIES WHICH ARE INJURIOUS TO FRUITS AND VEGETABLES.

In my First Annual Report I gave an account of the common Plum Curculio, which was as complete as our knowledge of the insect would then permit. Since the publication of that Report many new and most important facts, relating to this insect, have been brought to light, and I deem it wise in this review of some of our more injurious snout-beetles, to lay these facts before the reader. Many of them were embodied in an essay read by myself at the Fifteenth Annual Meeting of the Illinois State Horticultural Society, recently held at Galesburg, in that State, and therefore, with some important additions, I reproduce that essay, which embraces the first five insects here treated of.

Insects, like other animals, derive their nourishment from the vegetable and animal kingdoms; but a glance is sufficient to show that they possess a far greater field of operations than all the other animals combined. Indeed, the food of insects is a theme so large that I might occupy page after page by dwelling upon it alone. The other animals use as food but a very small portion of the inexhaustible treasures of the vegetable kingdom, and the remainder is unpalatable or even poisonous to them. Not so with insects, for, from the gigantic *Banyan* which covers acres with its shade, or the majestic Oak, to the invisible fungus, the vegetable creation is one vast banquet, to which they sit down as guests. The larger plant-feeding animals are also generally confined, in their diet, to the leaves, seeds or stalks, being either foliaceous or farinaceous; but insects make every possible part of a plant yield them valuable provender. We have an excellent illustration of this omnipresent character of insects in those species which are well known to attack the common apple tree. Thus, beginning at the root, we find it rendered knotty and unhealthy on the outside by the common Root-louse (*Eriosoma pyri,* Fitch), while the heart is often entirely destroyed by one or the other of two gigantic Root-borers (*Prionus imbricornis*, Linn, and *P. laticollis*, Drury). The trunk is riddled by the larvæ of several Long-horn beetles, and pre-eminently by the Two-striped Saperda (*Saperda bivittata*, Say), as well as by other smaller beetles; the liber and alburnum are destroyed by the Flat-headed borer (*Chrysobothris femorata*, Fabr.), the outer bark eaten by bark beetles (*Scolytus* family) and sucked by Bark-lice peculiar to it. The branches and twigs are bored along the axis and pruned by the larvæ of the common Pruner (*Elaphidion villosum*, Fabr.), and by that of the Parallel Pruner (*E. parallelum*, Lec.), girdled by the Twig-girdler (*Oncideres cingulatus*, Say*), sawed and rasped by the Periodical Cicadas (*Cicada septemdecim*, Linn, and *C. tredecim*, Riley), otherwise known as Seventeen-year Locusts, by tree-hoppers and a dozen other Homopterous insects; bored into from the side by the Twig-borer (*Bostrichus bicaudatus*, Say), wounded by the bites of such beetles as the New York Weevil (*Ithycerus novæboracensis*, Forster), or pierced as by a red-hot wire by small boring beetles (*Scolytidæ*).

The buds before they expand are infested with the larvæ of the Apple Bud-moth (*Grapholitha oculana*, Harr.), or entirely devoured by voracious cut-worms (*Agrotis scandens*, Riley, etc.). The blossom has no sooner unfolded its delicate and beautiful petals than it is devoured entirely either by the Brazen Blister Beetle (*Lytta ænea*, Say), the Striped Cucumber Beetle (*Diabrotica vittata*, Fabr.), the Rose bug, or by a great many other insects that might be mentioned, some, as the different bees, confining themselves to the pollen or honey from the nectaries, while others again prefer other parts. The young fruit is either eaten partly or entirely by Snapping beetles (*Melanotus communis* and *M. incertus*), or punctured by either the Plum or Apple Curculios, and afterwards bored through and through by their larvæ, or by that ubiquitous Apple Worm (*Carpocapsa pomonella*); as it matures it is eaten into by the larvæ of the Plum Moth † (*Semasia prunivora*, Walsh), rendered putrid by the Apple Maggot (*Trypeta pomonella*, Walsh), and by the Apple Midge (*Molobrus mali*, Fitch); as it ripens it is gouged by the Flower Beetles (*Euryomia inda* and *E. melancholica*), and disfigured by a variety of other insects, while the skin is often gnawed off and corroded by the larvæ of the Rose Leaf-roller (*Loxotœnia rosaceana,* Harr.); and even the seed, if it should be preserved, will be attacked by the Grain Sylvanus (*Silvanus surinamensis*, Linn.), the Dwarf Trogosita (*T. nana*, Melsh.) and the larvæ of one or two small moths. And as to the leaves, they are not only sapped and curled by the Apple Plant-louse (*Aphis mali*, Fabr.), and by leaf-hoppers; rolled by several leaf-rollers; folded at the edges by a small pale, undescribed worm which I shall soon describe; blistered by the Rosa Hispa (*Uroplata rosa*, Weber);

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*I have bred specimens of this insect from apple twigs.

†Inappropriately so called by Mr. Walsh, as I shall presently show.

crumpled by the Leaf Crumpler (*Phycita nebulo*, Walsh), mined by the Apple Micropteryx (*Micropteryx pomivorella*, Pack.); skeletonized and tied together by another undescribed worm, which I shall some day name *Acrobasis Hammondii;* but they are greedily devoured by a whole horde of caterpillars, from the tiny *Micropteryx* to the immense Cecropia worm, some of which confine themselves to the parenchyma, some to the epidermis, some to the tender parts, without touching the veins, while others bodily devour the whole leaf. The sap forms the sole food of some insects, and even when the poor apple tree dies, a host of different insects revel in its dead and decaying parts, and hasten its dissolution, so that it may the more quickly be resolved into the mold from which it had, while living, derived most of its support, and through which it is to give nourishment for the young trees which are to take its place.

Thus we perceive that there is not a single part of the apple tree which is not made to cradle, or to give nourishment to some particular insect, and the same might be said of almost every plant that grows on the face of the earth, even those which produce resinous or gummy substances, or which are pithy in the center, having special insects which feed upon these parts and on nothing else. There are insects— the gall makers, for instance—which, not satisfied with any existing part of the plants, as such, cause abnormal growths, in which their young are reared.

Nor are insects confined to vegetables in their recent state. The block of hickory wood, fifty years after it is made up into wagon wheels, is as palatable to the Banded Borer (*Cerasphorus cinctus*, Drury), which causes "powder-post," as it was to the Painted Borer (*Clytus pictus*, Drury) while green and growing; and a beam of oak, when it has supported the roof of a building for centuries, is as much to the taste of an *Anobium* as the same tree was while growing, to the American Timber Beetle (*Hyleœctus Americanus*, Harr.) Some, to use the words of Spence, "would sooner feast on the herbarium of Brunfelsius, than on the greenest herbs that grow," and others, "to whom

'——— a river and a sea
Are a dish of tea,
And a kingdom bread and butter,'

would prefer the geographical treasures of Saxton or Speed, in spite of their ink and alum, to the freshest rind of the flax plant."

Indeed, it would be difficult to mention a substance, whether animal or vegetable, on which insects do not subsist. They revel and grow fat on such innutritious substances as cork, hair, wool and feathers; and "with powers of stomach which the dyspeptic sufferer may envy, will live luxuriously on horn;" they insinuate themselves into the dead carcasses of their own class; they are at home in the hottest and strongest spices, in the foulest filth, in the most putrid carrion; they can live and thrive upon, or within the living bodies of the larger animals, or of those of their own class; they are at home in the intestial heat of many large animals, reveling in the horse's stomach, in a bath of chyme of 102° Fahr., or in the bowels of man, in an equally high temperature. Some have even been supposed to feed on minerals, and, not to dwell upon Barchewitz's tale of East India ants, which eat iron, certain it is that the larvæ of our May flies (Ephemeræ) do eat earth, and I have known the larvæ of the common May Beetle to feed for three months upon nothing but pure soil; but in both these cases the insects undoubtedly derive nourishment from the vegetable matter which is extracted from the earth by the action of the stomach.

These facts will serve to show that, seek where we may, we cannot find a place or a substance in which or on which, some insect does not feed. They people the atmosphere around us, swim at ease in the water, and penetrate the solid earth beneath our feet; while some of them inhabit indifferently all three of these elements at different epochs of their lives.

Now when we reflect that there are at least half a million—if not a full million—distinct species of insects in this sublunary world of ours, and that their habits and habitations are so diversified, it would really seem as though entomology was a subject too vast for any one man to shoulder; and indeed it is in all conscience extensive enough. The science of entomology is, however, so perfect in itself, and its classification so beautiful and simple that a particular species is referred to its Order, its Family, its Genus, and finally separated from the other species of that genus, with the greatest ease, and with a feeling of true satisfaction and triumph, by those who have mastered the rudiments of the science. And, very fortunately, it is not necessary for the practical fruit-grower to enter into the minutiæ of species or even of genera in order to learn the habits of the insects which interest him in one way or another. These minutiæ must be left to the professed entomologist.

There is not an insect on the face of the globe which cannot be placed in one or the other of seven, or more properly speaking, eight great Orders; so that, unlike the botanist, the entomologist is not bewildered by an innumerable array of these Orders, though he has five times as many species to deal with. These Orders comprise about two hundred families, many of which may, for practical purposes, be grouped into one family—as, for instance, the seven families of Digger-wasps and the five large families which have all the same habits as the true or genuine Ichneumon-flies. Many more may be neglected as small, rare, or unimportant; so that practically there will remain about a hundred family types to be learned. Each family, as Agassiz, has well remarked, may, with a little practice, be distinguished at a glance by its general appearance, just as every child with a little practice, learns to distinguish the family of A's from the family of B's, and these from the family of C's in the alphabet. There is the old English A, the German text A, and a host of ornamental A's, both in the capital letter and the small or "lower-case" letter, as the printers call it; but the family likeness runs through all, and it is astonishing how quick a child learns to distinguish each family type. It is true there are a few abnormal or eccentric insects —there were some which deceived even Linnæus—which put on the habit of strange families, just as an eel, which is a true fish with fins, puts on the habit of a snake—a reptile without fins. But these are the exceptions and not the rule.

Now it is wisely ordained that every family, as a general rule, has not only a distinctive family appearance, but also distinct family manners. For example, nobody ever saw an Ichneumon-fly construct a nest and provision it with insects, as does a Digger-wasp; and nobody ever saw a Digger-wasp deposit its eggs in the body of a living insect at large in the woods as an Ichneumon-fly does. But each family maintains its peculiar family habits, and cannot be induced to deviate from them.

So universally is this the case, that if an insect is brought me which I never saw in my life, I will tell half its history at a glance. It is this "Unity of Habits," this beautiful provision of nature—definite family likeness, accompanied by definite family habits—which so simplifies the task of the practical man; for, instead of having to study the diversified habits of half a million species, he has but to acquaint himself with the appearance and characteristics of one hundred families; and if the rudiments of Entomology had been taught in the schools of this country, so that the farmer had become familiar with these hundred family types, he would now be much better able to cope with his insect enemies. When I think that it would take a child no longer to learn these one hundred family types than it does to learn the one hundred different types which compose the four alphabets—the Roman capital and small alphabet and the writing capital and small alphabet—I fully expect, and sincerely hope, that in the public schools of this country we shall soon have text-books introduced which will cover the ground as well, and occupy the same place as do those useful works of Leunis, and Troschel and Ruthe, in the public schools of Germany.

With these few remarks, which are intended to show that the practical man may easily obtain a general knowledge of his insect friends and enemies, notwithstanding the wide field of their operations and the immense number of species which exist, we will now dwell for a while on one of these families, which deeply interest us as fruit-growers, namely:

THE CURCULIONIDÆ OR SNOUT-BEETLES.

This is one of the very largest and most conspicuous families in the Order of Beetles (*Coleoptera*), comprising, as it does, over 10,000 distinct and described species. It is at once distinguished from all the other families of beetles by the front of the head being produced into a more or less elongated snout or rostrum, at the extremity of which the mouth is situated. This snout is sometimes very long and as fine as a hair (genus *Balaninus*), and sometimes as broad as the head (genus *Brenthus*); but it always forms part and parcel of the head, and does not articulate on it as does the snout or proboscis of the true Bugs (*Hemiptera*), or the tongue of Moths and Butterflies. The other chief characteristics of the family are an apparently four jointed tarsus or foot (though in reality there are more generally five joints), an ovoid form narrowing in front, the sides pressed by the convex elytra or wing-covers, the antennæ or feelers attached to the snout, and either elbowed or straight, and composed of nine, ten, eleven or twelve joints—the first of which is always long, and the terminal three generally united in a club or knob; and finally stout legs with swollen thighs, sometimes bearing spines.

The larvæ of these snout-beetles are whitish or yellowish and fleshy grubs, usually without legs or having only in the place of them fleshy tubercles, which in a measure perform the functions of legs;* the body is oblong, with the back generally arched but sometimes straight. With these characteristics in mind, the farmer cannot fail to recognize a snout-beetle when he sees one. Now there is hardly one of the one hundred families that I have referred to from which so many injurious species can be enumerated, for with the exception of an European species (*Anthribus varius*) whose larva was found by Ratzeburg to destroy bark-lice, they are all vegetarians, the larvæ inhabiting either the roots, stems, leaves or fruits of plants; and the beetles feeding on the same. So whenever you find an insect with the characters just given, you may rest morally certain that it is injurious, and should be destroyed without mercy. This family is not only one of the most injurious, but, on account of the secretive habits of the larvæ, thè insects comprising it are the most difficult to control. When a worm is openly and above board denuding our trees, we at least readily become aware of the fact, and can, if we choose, apply the remedy; but when it surreptitiously, and always under cover, gnaws away at the heart of our grains and fruits, we become in a measure helpless to defend ourselves. But even here where the enemy is so well ambushed and hidden, the proper tactics, based on thorough knowledge, will frequently enable us to penetrate the defenses and conquer the foe.

Before leaving this subject of families, let me impress upon the mind another important fact, namely, that the family is not peculiar to any one country, and that while species vary, the family has the same habits and characteristics all over the world. Thus in Europe

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*It is generally unqualifiedly stated by authors that Curculionid larvæ are apodous; but there are exceptions to the rule, and I may cite as an example the larva of *Cratoparis lunatus*, Fabr., which I have found in fungi, and have bred to the perfect state, and which has six conspicuous thoracic legs.

we find the snout-beetles as injurious, and as difficult to manage—if not more so—than they are in this country. One species (*Rhynehites conicus*, Herbst.,) deposits eggs in the twigs of Pear, Plum, Cherry and Apricot, and girdles the twig to make it fall; another, (*Rhynchites bacchus*, Schœn.) infests the fruit, and still another (*Anthonomus pyri*, Schœn.) the flower bud of the Pear. One, (*Rhynchites betuleti*, F.,) rolls up grape leaves and partly cuts the stems, so that they perish, while another, (*Anthonomus pomorum*, Schœn.,) infests the blossom bud of the Apple, and renders it unfertile. Still another inhabits the blossom bud of the Cherry. *Balaninus nucum* is found in their common Hazel-nut, and *B. cerasorum* in Cherry pits; *Apion apricans* devours the seed of Clover; *Otiorhynchus sulcatus*, Schœn., infests the crown of strawberries and two different species (*Baris chlorizans*, Schœn., and *Ceutorhynchus napi*, Schœn.,) infest the stems of cabbages and turnips.

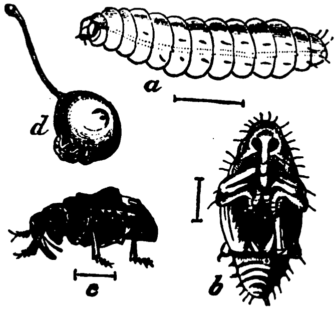
But after all, a single species—the "little Turk," for instance—sometimes causes more loss of fruit in this country than all the above enumerated species do to the European cultivator, and though much of this comparative incapacity for harm, on the part of their insects, may be in a measure due to the better knowledge of his foes which the transatlantic cultivator possesses; to the more careful culture which he pursues, and the usually limited extent of his orchard, compared with ours; yet it greatly depends on other causes, which it is not necessary now to dwell upon. So I will at once proceed to say a few words about those of our own Snout-beetles, which more particularly interest us.

THE COMMON PLUM CURCULIO—*Conotrachelus nenuphar*, Herbst.

IT IS SINGLE BROODED, AND HIBERNATES AS A BEETLE.

I shall not here repeat what has already been published about this insect; but shall confine my remarks principally to the unsettled and mooted points in its natural history, and to the new discoveries that have been made since the appearance of my first Report. I am glad to be able to say that I have forever settled the principal question, namely, as to its being single or double brooded. Authors have, from the beginning, held different views on this subject, and this fact should not surprise us, when we bear in mind that

[Fig. 1.]



they reasoned simply from conjecture; nor will it surprise us when we understand the facts in the case. The facts that fresh and soft Curculios are found in this latitude as early as the last of June, and that they still come out of the ground in August, or as late as September, and even October in more northerly latitudes, are well calculated to mislead; while it was difficult to imagine an insect living ten months before ovipositing, without dwindling away through the action of its enemies. But in the beetle state, the Curculio has few, if any enemies, and in my former writings on this subject, I have shown that the other facts do not in the least prove the insect to be double-brooded. Among those whose opinions commanded respect, from their profound entomological knowledge and general accuracy, was Mr. Walsh, who, during his last years, strenuously contended that this insect was double-brooded. For several years I have entertained a different opinion, believing that it was single brooded, as a rule, and only exceptionally double-brooded; and the facts so fully bear me out in this opinion, that were my late associate living to-day, I should bring forth the testimony with a feeling of triumph, for he was not often in the wrong! It is worthy of remark, however, that Mr. Walsh's first impression, as given by him in the year 1867*, was that this insect is single brooded; his first opinion thus coinciding with what I have now proved to be the facts in the case. In my first Report I have reviewed the experiments which led him to change his opinion, and have shown that they did not warrant his final conclusion.

The many words that have been penned in the discussion of this question would fill a volume; but one stern fact, one thorough experiment, is worth more than all the theories that were ever conceived, or the phrases that were ever written on the subject. At first it seems to be a very simple question to settle, but the fact that it remained unsettled so long would indicate the reverse. Judge A. M. Brown of Villa Ridge, at my suggestion, endeavored in the summer of 1869 to solve the problem by imprisoning the first bred beetles and furnishing them with plucked fruit. Dr. Hull partially performed a like experiment, and I did the same myself; but we were met by the advocates of the two-brooded theory with the objection that such a test was of no value, as the Curculio would not deposit on plucked fruit or in confinement; and to add weight to their argument they could cite us to numerous instances among butterflies to prove that many insects really will not deposit in confinement. But, as we shall see, they placed too much confidence in the instinct of Mrs. Turk when, from such premises, they made these deductions apply to her.

As I proved over and over again, the question could not be solved with any more certainty, by confining beetles to living boughs containing fruit, as the boughs could not well be covered with any substance through which the beetles would not gnaw their way out. So I determined last spring to build a frame over a large tree and entirely enclose it in stout gauze, that would neither let a flea in or out, much less a Curculio. Having accomplished this before the blossoms had fallen off the tree, I awaited with pleasurable interest the result from day to day, from week to week, and from month to month; engaging a competent person to watch, when, from necessity, I was obliged to be away. It were worse than waste of time to detail here the many interesting observations made on this tree which I had under control, or to enumerate the many other experiments which I conducted in other ways, or the innumerable facts obtained; and it will suffice to give in a summary manner the results—premising only that every precaution was taken, and no expense spared, to prevent failure; that the experiments were satisfactory beyond my expectations, the results conclusive beyond all peradventure, and that I can prove every statement I make. To sum up then:—*The Plum Curculio is single-brooded*, and I have a number now alive *which were bred during the latter part of June from the first stung peaches.* (At the time the printer is ready for this Report the beetles are still alive and flourishing—February 24th, 1871.) But, as there seem to be exceptions to all rules, so there are to this; yet the exceptions are only just about sufficient to prove the rule, for as far south as St. Louis not more than one per cent. of the beetles lay any eggs at all, until they have lived through one winter; or in other words, where one female will pair and deposit a few eggs the same summer she was bred, ninety-nine will live on for nearly ten months and not deposit till the following spring. In more northern latitudes I doubt if any exceptions to the rule will be found.

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* Practical Entomologist, Vol. II., No. 7.

As to the other mooted point, namely, whether this insect ever hibernates under ground in the larva state, I am perfectly satisfied that it never does, but that it passes the winter invariably as a beetle, under all sorts of shelter in the woods; generally, however, near the surface of the ground. Indeed, it often makes for itself a hole in the ground, seldom however deep enough to more than barely cover its own body. In short, there is very little to alter or modify in the established facts in its natural history, which I have already published. The egg, instead of being "oval," as there stated, would be better described as "oblong-oval," measuring exactly 0.03 inch in length, and being nearly three times as long as wide. It should also be remarked here, that when depositing the eggs in apples, the female often neglects the usual symbol of Mohammedanism, which she so invariably inscribes upon stone fruit; and that where this mark is made on apples, it more easily becomes obliterated.

During their beetle life, these insects feed continually, just as long as the weather is mild enough to make them active. While fruit lasts, they gouge holes in it, and after peaches have gone, apples are badly attacked. They also gnaw large holes in the leaves, and when nothing else presents, will feed on the bark of the tender twigs.

The beetles often make a peculiar creaking noise (a fact not mentioned before of this species) by rubbing the tip of the abdomen up and down against the wing-covers.*

Let us be thankful, therefore, that there can no longer reasonably be difference of opinion, or discussion on these questions, which, though of no very great practical importance, were yet of great interest to us all.

IT IS NOCTUNRAL RATHER THAN DIURNAL.

Before leaving this little Turk, however, I have some other facts to mention which were first brought to light the present year, and which have a most important practical bearing. The people of the West have been repeatedly told, and with so much assurance that they no doubt have all come to believe it as gospel, that Curculios fly only during the heat of the day, and that it is useless to endeavor to catch them after say 10 o'clock in the morning. What I am about to utter will no doubt astonish many, but I know whereof I speak. *The Curculio is a nocturnal rather than a diurnal insect; is far more active at night than at day, and flies readily at night into the bargain.* If any one doubts this assertion, let him go into his peach or plum orchard at midnight with a lantern and sheet, and he will catch more than he could during the day, and will also find, to his sorrow, that they are then much more nimble and much bolder—

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*A great many different beetles belonging to widely different families have the power of making a stridulating creaking noise, and though the instrument is found upon different parts of the body in different species, yet it is always made after one plan, namely, a file-like rasp and a scraper. In Darwin's new book (Descent of Man, pp. 366–73) an interesting account of the different methods employed will be found. Every entomologist knows how commonly this creaking noise occurs in the Long-horn beetles, and that the rasp is situated on the mesothorax and is rubbed against the prothorax. In the Burying beetles (NECROPHORIDÆ) these rasps are situated on the fifth abdominal joint, and are scraped by the posterior margin of the elytra. In the Dung-beetles again it is variously situated upon different portions of the body. Dr. Fitch (10th Ann. Rep. p. 12) has noticed the creaking noise made by the Three-lined Leaf-beetle (*Lema trilineata*) which is produced by the same motions as those witnessed in our Curculio; but in this instance, as in all other stridulating Chrysomelidæ, the rasp is situated on the dorsal apex of the abdomen known as the pygidium, and is scraped by the wing-covers; while in the closely allied Curculionidæ which have this power the parts are completely reversed in position. Any one who will take the trouble to carefully examine the wing-covers of our Plum Curculio will find on the lower apical edge of each, a horny, slightly raised plate, about a third as long as the whole wing-cover, and transversely and obliquely ribbed by numerous parallel ridges. There is also a longer cord or carina near the sutural edge which may help to intensify the noise. The dorsal apex of the abdomen or pygidium forms a yellowish and roughened plate, with the sides horny and emarginate, so that when the abdomen plays up and down, these horny edges grate or scrape at right angles against the rasp.

In some instances the stridulation is possessed principally by one sex and serves no doubt as a sexual call; but with our Curculio as with most other stridulating beetles, both sexes seem to share alike in the power, and it then no doubt serves as a mutual call, or is used under the influence of distress, fear, or even pleasure; for I have always more particularly noticed the noise of an evening when the Curculios were most active and preparing for their active night work.

scarcely feigning death at all. Indeed, with the exception of such females as are busily occupied in depositing eggs, most of the Curculios rest during the day, sheltered either by the foliage or branches of the tree, or by any extraneous substance on the ground near by. They are also more active in the evening than in the morning, and these facts lead us to the important question, whether the morning or the evening is the best time to jar the trees. My experiments so far are not conclusive, for I have some days caught more in the morning, and at others more in the evening. All other things being equal, the evening will prove preferable to the morning, from there being less dew at that time; and I particularly draw attention to this matter now, that the proper experiments may be instituted during the coming year by more than one individual.

THE RANSOM CHIP-TRAP PROCESS.

Another grand and successful mode of fighting the little Turk was also brought to light again, and to a great extent practiced the past summer. I allude to the Ransom chip process for entrapping this insect. About the middle of May the Horticultural world was startled by a somewhat sensational article, which was the burden of an extra to the St. Joseph (Michigan) *Herald*, headed:—"Great Discovery—Curculio Extermination Possible." The process consists in laying close around the butt of the tree pieces of chips or bark, under which, according to their instinct, a great many of the Curculios secrete themselves during the day, and may thus be easily destroyed. Now that we better understand this insect's habits, we also better comprehend the philosophy of this process. Being noctural in their habits, the beetles naturally seek shelter during the day, and especially is this the case early in the season, when the days are chilly, and before the females are too much engaged in egg depositing. Numerous opinions were expressed as to the value and efficiency of this method; but I will here repeat my own, as given to the readers of the *American Entomologist and Botanist;* first, because I endeavored to be candid and truthful, and secondly, because the opinions expressed have been so far fully corroborated by subsequent experience. Let it be distinctly understood that in recording what I believe to be the facts in the case, I have no wish to detract one particle from the credit due Mr. Ransom, for bringing this method prominently before the people, and demonstrating its practical applicability; for to him undoubtedly belongs the honor of the re-discovery and of the proper application of the method:

"We are really sorry to damp the ardor and enthusiasm of any person or persons, when enlisted in such a good cause, but truth obliges us to do so, nevertheless. Of course Curculio extermination is possible! but not by the above method alone, as our Michigan friends will find to their sorrow. For a short time, early in the season, when the days are sometimes warm and the nights cold, and before the peach blossoms have withered away, we have succeeded in capturing Curculios under chips of wood and in other such sheltered situations; but we have never been able to do so after the fruit was as large as a hazlenut, and the little Turk had got fairly to work. Our Michigan friends will, we fear, find this to be too truly the case.

"This process, furthermore, cannot well be called a new discovery, because it was discovered several years ago, as the following item from Moore's *Rural New Yorker* of January 28th, 1865, will show:

> "How to catch Curculio.—In May last we had occasion to use some lumber. It was laid down in the vicinity of the plum yard, and on taking up a piece of it one cold morning, we discovered a number of curculios huddled together on the under side. On examining other boards we found more, so we spread it out to see if we could catch more, and we continued to find more or less every day, for two weeks. We caught in all one hundred and sixty-one. So I think if people would take a little pains they might destroy a great many such pests. These were caught before the plum trees were in flower. What is most singular is, that we never found a curculio on a piece of old lumber, although we put several pieces down to try them. They seemed to come out of the ground, as we could find them several times a day by turning over the boards.
>
> Johnsonville, New York. Mrs. H. Wier.

"But though Mr. Ransom cannot properly claim to have made a new discovery, and although this mode of fighting will not prove sufficient to *exterminate* the Curculio, yet we greatly admire the earnestness and perseverance which he has exhibited. In demonstrating that so great a number of the little pests can be entrapped in the manner described, Mr. R. has laid the fruit growers of the country under lasting obligations to him. It is a grand movement towards the defeat of the foe, and one which, from its simplicity, should be universally adopted early in the season. But we must not relinquish the other methods of jarring during the summer, and of destroying the fallen fruit; for we repeat that the Plum Curculio will breed in the forest."

I subsequently visited St. Joseph, for the express purpose of examining more closely into Mr. Ransom's Curculio remedy. I found that so few Curculios had been caught under the chips after the first week in June, that nearly everybody, except Mr. Ransom, had for some time abandoned the method, and were jarring their trees by one process or another. Mr. Ransom himself, by dint of unusual perseverance and great care in setting his traps, had much better success than I had expected he would. On the 15th June he caught 78; on the 16th, 97; and on the 17th, 71. For about a week after this he scarcely caught any, but from the 24th to the 27th inclusive, he caught about 300. On the 6th of July I accompanied him around the outside rows of his orchard and caught five under the traps. We had no opportunity to use the sheet, but I am satisfied that more could have been jarred down. Mr. R. had a very fair crop of peaches, and—forgetting that crops have often been grown before with very little care, and that others around him who did not bug so persistently had fruit also this year—is very sanguine of his new method, and too much inclined, perhaps, to attribute his crop solely to this remedy. Nevertheless, contrary to the impression made by his published views, he was candid enough to admit that it might be found necessary to resort to the jarring process, after a certain season of the year; and indeed the number of stung peaches on the ground showed too plainly that there is no hope of *extermination* by the chip plan alone. The soil around St. Joseph is, for the most part, a light sandy loam, never packing, and very easily kept in good cultivation. To this character of the soil must be attributed much of the success with the Ransom method; for I am satisfied, after full experiment, that in the warmer climate and heavier soil of St. Louis, it is of no practical use after the middle of May, or at the farthest, after the first of June. The few specimens that I have captured by this method at St. Louis were found under small pieces of new shingle; and Mr. W. T. Durry, who has 2,300 trees in his orchard at St. Joseph, also found this the best kind of trap. Mr. Ransom, however, prefers small pieces of oak bark, which he places close around the tree, with the inner or concave side pressed to the ground. Stones do not answer well, and corn cobs are objectionable because it requires so much time to discover and destroy the Curculios, which hide in their deep cavities.

The best time of day to take the Curculios from under the chips is undoubtedly in the afternoon; but it must not be left too long, as they begin to leave and scatter over the trees as soon as the sun approaches the horizon. The chips should be laid around the trees as soon as the frost is out of the ground, or at least by the time the blossoms begin to expand; for more beetles will be caught under them during a few weeks thus early in the season than throughout the rest of the year.

Before concluding this branch of the subject, I earnestly urge upon fruit-growers throughout the State to give this process a good trial during the coming season, and to report the results to me. The observations of a hundred persons in as many different parts of the State must necessarily be of more value than those of a single individual in any one locality; and as the process was not prominently brought before the public last year, until it was too late to make thorough experiments, it is very desirable to have the true value of the method in Missouri definitely ascertained in 1871. To arrive at such definite knowledge of its value, I need the co-operation of intelligent fruit-growers, and for this reason I hope that notes and experiments will be made and sent to me at my office, any time during the summer. The number of trees experimented on, number of beetles captured, time of year, hour of day, character of soil, and all other facts connected with the experiments should be noted; as they all help us to a more thorough knowledge of the true value of the process

KEEPING IT IN CHECK BY THE OFFER OF PREMIUMS.

After visiting St. Joseph and vicinity, I passed into Ontario, where I found the trees overloaded with fine unblemished fruit. I found my friend, Mr. Wm. Saunders, of London, also much occupied with, and interested in, the Curculio question. He was, in fact, carefully counting different lots of this insect which had been received from different parts of the Dominion; for be it known, that the enterprising Fruit-Growers' Association of Ontario, in its praiseworthy efforts to check the increase of the Curculio, offered *a cent per head* for every one which should be sent to our friend, who happens to be secretary of that body. What would our own people think if the Legislature or the State Horticultural Society should offer an equally liberal premium *per capita* for every little Turk captured? Wouldn't they set about capturing them in earnest, though! The Legislature might stand it, and I am not sure but that some such inducement, held out by the State to its fruit-growing citizens, would pay, and prove the most effective way of subduing the enemy. But the Horticultural Society that should undertake it, would have to be pretty liberally endowed. Just think of it; ye who catch from three to five thousand per day. The bugs would pay a good deal better than the peaches. However, very fortunately for the Ontario Fruit-Growers' Association, their good offer did not get noised abroad as much as it might have been, and the little Turk occurs there in such comparatively small numbers, that up to the time I left only 10,731 had been received.

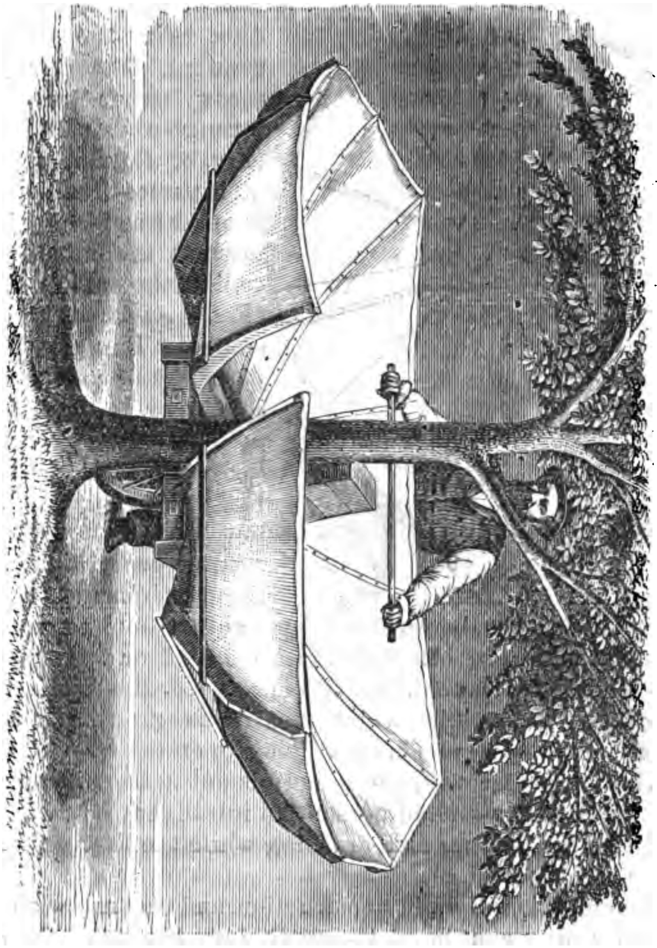
PARIS GREEN AS A REMEDY.

Mr. G. M. Smith, of Berlin, Wisconsin, in an article written last fall to the St. Joseph (Mich.) Horticultural Society, recommends Paris Green for the Plum Curculio. Even if the uniform application of such a poisonous drug on large trees were practicable, it would never succeed in killing one Curculio in a hundred. Paris Green kills the leaf-eating beetles by being taken internally with the leaves; but the Curculio, with its snout, prefers to gouge under the skin of the fruit, and only exceptionally devours the leaves. Yet, notwithstanding the palpable absurdity of the remedy, it has very generally passed from one journal to another without comment.

JARRING BY MACHINERY.

Of course there is no more expeditious way of jarring down the Curculio than by the Hull Curculio-catcher (Fig. 2.) Yet I confess that after extensive observations in many different parts of the country I am forced to the conclusion that this machine does not give the satisfaction one could wish. I have already shown that where it was constantly used the trees suffered serious injury from bruising, and it is a rather significant fact that in most orchards where it has been introduced, some modification has soon followed, or else it has been entirely abandoned; while in the East they still adhere to the improved stretchers and mallet. It seems to me that the machine, as made by Dr. Hull, two years ago, was not only too heavy and unwieldy, but incapable of giving the requisite sharp jarring rap to the branches of a large tree without causing too much injury to the trunk; and that if a modification of it could be made to satisfy the peach-grower, there would soon be a greater demand for such a machine.

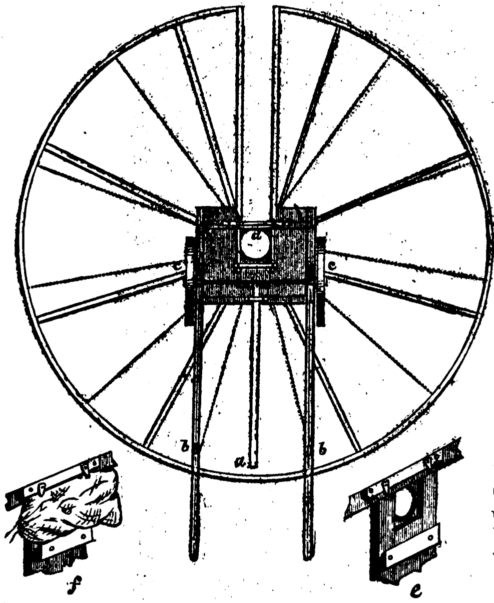
[Fig. 2.]



[A full description of this machine, without any figure, was given in my first Report, pp. 60-61.]

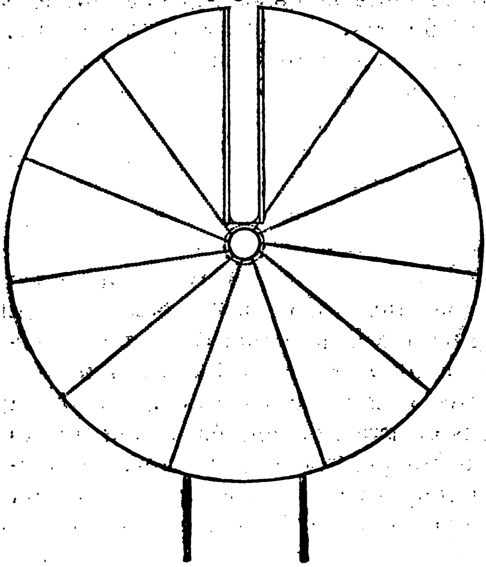
As a step in the right direction I will briefly describe a machine which I have herewith illustrated, (Fig. 3, back view; Fig. 4, front view), and which I found in quite general use around St. Joseph and Benton Harbor, Michigan. It was gotten up by Mr. L. M. Ward of the latter place, and proves, in the orchard, to have decided advantages over the Hull machine, of which it is a modification. It is a much lighter machine, and, as the diagrams indicate, instead of running on a single wheel it is carried and balanced by two, (Fig. 3, *c c*) and supported with legs on the handles, (Fig. 3, *b b*), when not running. The Curculios and stung fruit are brushed through a hole in the centre (Fig. 3, *d*), and as the operator passes from one tree to another he closes this hole, to prevent the beetles from escaping, by means of a slide, (Fig. 3, *a*), which he has under control. Bags previously prepared, by being fastened on a square piece of wood with a hole in the centre corresponding to a hole in the side of the bag, are snugly buttoned below (Fig. 3, *e* and *f*), so as to secure everything that falls through from above, and when one bag is full it is easily replaced by another, and its contents destroyed by scalding, or otherwise, and emptied out. In most of the orchards where this machine was being used, the jarring was performed by a separate mallet, which is easily hung, as is also the brush, on the shafts when the machine is being operated by one person, or, which I think a better way, where help is not scarce, it can, with the brush, be carried by a second person (an intelligent boy will answer,) who performs the jarring and brushing while the first person wheels the machine.

[Fig. 3.]



The machine is simple in construction, and any one with ordinary mechanical ability can build it—modifying, of course, the diameter of the wheels and the inclination of the sheet to suit the character of his trees or of his ground. Mr. Ward has taken no patent out for it, and the machine is, therefore, public property. The platform may be made narrower than shown in the illustration, for the nearer the wheels approach and the lighter the machine, the better. It has been argued in favor of the one-wheel machine, that it can be more easily

[Fig. 4.]



run on rough ground and more readily turned, which, in a great measure, is true; but the Ward machine might be so made that it could easily be tilted on one wheel in turning, and our Benton Harbor friends have so far found no difficulty in operating it. The two wheels have the additional advantage that the machine is not rendered unwieldy by strong wind. It also stands firm when left by the operator, who is thereby better enabled to use a mallet if he prefers it, the mallet being hung to the shafts, and taken down after the machine is wheeled into position. Either machine can be used with a bumper, or with a mallet, and there are certain rules which should be adopted in jarring for the Curculio, no matter whether a one-wheel or a two-wheel machine is used. These rules are: First. In jarring with a mallet, it is best to prepare each tree by squarely sawing off some particular limb, or else the mallet must be well protected with rubber to prevent bruising of the tender bark. The former custom is by far the best, as we are enabled to give the tree a sharp, vibrating rap with the bare, hard wood. Secondly. If the mallet is dispensed with, and the tree is bumped with the machine—a method which certainly has the advantage of expedition—it will be found altogether more profitable to drive a shouldered spike or to insert a shouldered screw in the trunk at the right distance from the ground, and the jarring can then always be done on this spike without injury to the tree.

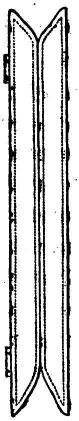
If the trees are headed high enough to admit of a sufficient inclination of the canvas, the beetles will naturally roll to the centre and fall into whatever receptacle there may be for them below; but such an inclination is not often practicable, and the brush or broom is almost always needed.

The orchardist must also be guided in his choice of machines by the character of his land, for the two-wheel machine doubtless owes much of its success around St. Joseph, Michigan, to the smoothness of their land. No machine will work well on rough, cloddy soil.

There are various improvements that might be made in the above machine by any ingenious person, and at my suggestion Mr. J. E. Porter of the Eagle Agricultural Works, Ottawa, Illinois, has commenced building these two-wheel machines with adjustable arms. The canvas also is to be so made that it can be fastened on and taken off again so that the whole may be more compactly packed for shipping, and for storing away out of the wet. Exclusive of the canvas, the whole can be made ready for shipment for from $16,00 to $18,00, and the machine will no doubt be advertised the coming season.

It is gratifying to know also that the inventive genius of some of our Western men is being applied to the improvement of this implement. Thus Messrs. Claxton & Stevens of the Insane Asylum, St. Louis county, have just applied for a patent on a one-wheel machine, the principle feature of which is a bumper which works with a spring. I have seen the model, but am not favorably impressed with the machine as one having any great practical value. The spring bumper is an expensive and unnecessary addition, and in other respects the machine is inferior in utility to that I have just described. One good feature, however, is an arrangement for closing up the tree-way where the bumper touches the tree. It consists simply of two long strips of sheeting fastened to a light frame, each one of which is so attached to the sides of the tree-way that when dropped they form a roof as at Figure 5. The tree easily separates these two pieces when the machine is worked. The frame of this machine is quite flat with an upturned rim, but each half-circle is so arranged that it can be raised on hinges.

[Fig. 5.]

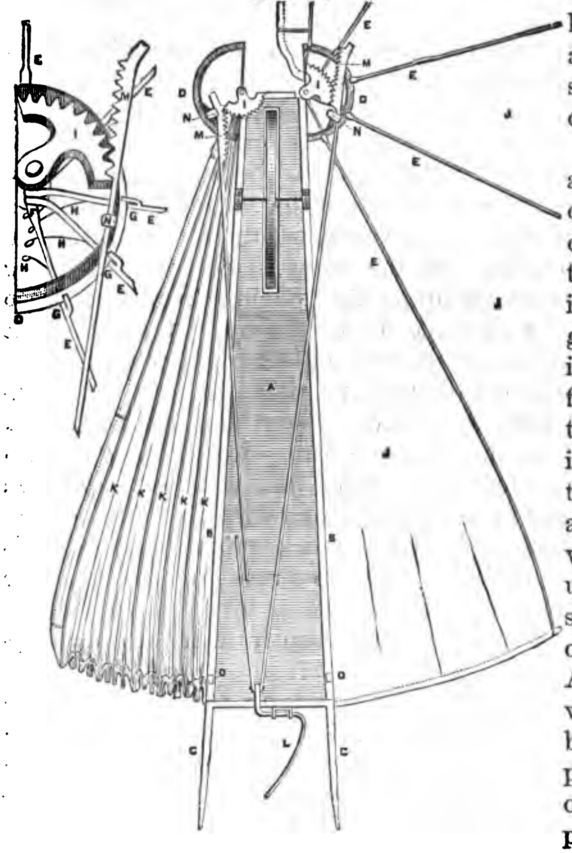


Dr. M. M. Hooten, of Centralia, Illinois, patented last summer a machine made very much after Dr. Hull's plan, but he has since made several improvements and changes and has made application for another patent for the improved machine which I herewith illustrate from a model with which he has kindly furnished me.

He first constructs a long narrow wheel-barrow with a level and smooth platform (Fig. 6, *a*,) made of ½ inch pine or other light material, firmly nailed down to two arms (*b*, *b*,) and covering them from the front end to within twenty inches of the rear end. These rear ends serve for handles (*c*, *c*). The anterior ends, at a point one foot from the extremity, rest upon the axles of the wheel, which is two feet in diameter. He then attaches a half circle (*d*, *d*) to each outer side of the forward ends of the arms of the platform. These half circles are ten inches in diameter, and are so placed as to be about two-thirds of their width in advance of the platform, which at the forward end is from ten to twelve inches wide. Thus enough room is left for the tree to be admitted between the flat sides of the half circles.

There are now to be five or six movable arms (*e*, *e*) placed on each side of these iron half circles, and a single half-inch bolt (*f*) passed through a hole in the inner ends of them, and through the straight bar next to the tree-way. The arms are now permitted to rest on the half circles, and are held down to the circle by a hook

[Fig. 6.]



which is attached to the lower side of the arm and curves over the outside of, and under, the circle (*g*, *g*).

These movable arms are now arranged at equal distances on the circles, and fastened with twine, while the canvas is being tacked on, beginning first by tacking it to the sides of the platform of the barrow and then to the arms. At the inner end of each of these movable arms is a raised finger (*h*, *h*), which holds the canvas up so as to keep any insects from being thrown over into the tree-way. A semi-circular cog-wheel (*i*, *i*), which works by its centre, is now placed on the lower end of the same bolt that passes through the inner ends of the movable arms. The forward arm on each side is firmly attached to this cog-wheel, which works under the canvas. When made to revolve backwards or forwards on the bolt, this cog-wheel carries the outside arm around on the iron half circle, and the sheet-covered frame is thus easily stretched and opened, as at *j*, *j*, or closed as at *k*, *k*.

This motion is quickly accomplished by means of a lever (*l*), which works on a hinge at the rear of the platform, and which moves a rod armed on one side at the forward end with cogs (*m*, *m*), which tread in the cogs of the semi-circular cog-wheel before described, to which it is held by a keeper (*n*). The handle of the lever lies on the platform when the machine is folded, and stands upright when it is extended; so that by a single motion of one hand of the operator, the machine may be folded into a very small compass, or as quickly extended. The hinder part of the machine is supported by two swinging legs (*o*, *o*). These may swing back to the handles, but cannot go forward beyond a right angle. The machine is very light, and works so easily that, according to the inventor, a boy of fourteen years can easily run one of them. The whole machine does not weigh over forty pounds.

The above figure represents a back view of the machine, with one side open and the other closed. The principle advantage of the machine lies in this folding apparatus, which enables the operator to defy the wind which on some days renders the original Hull machine almost useless as it plays powerfully against the stretched canvas. This feature also enables the owner to store the machine away with less trouble. I have my doubts, however, whether the advantage gained sufficiently compensates for the extra machinery. Another advantage which Mr. Hooton claims for the machine is that it is so low that it will swing its broad folds under low-headed trees. That portion of the wheel which rises above the platform is protected by a circular box, and it is found that every time the canvass is expanded, there is a slight jerk, which casts everything that has fallen upon it to the centre, where the bugs and fruit consequently remain until removed. The raised fingers to which the canvas is attached at the centre, and similarly raised pieces along each side of the tree-way, prevent the insects and fallen fruit from escaping; and there is no receptacle below into which they can be brushed. The machine is therefore built with the idea that it is as easy to pick up and remove the fallen beetles and fruit as it is to brush them into a receptacle below.

In operating the machine it is wheeled up to the tree while closed, then expanded and drawn back a little so as to give the tree a jar, and then closed and wheeled away to the next tree. Mr. Hooton has had a full sized machine in operation, and it seems to give very good satisfaction. As there is considerable casting needed, the ordinary fruit-grower will not be able to manufacture it as easily as he can the Ward machine; but as all these machines will doubtless be put upon the market the coming season, the reader must choose for himself which he prefers.

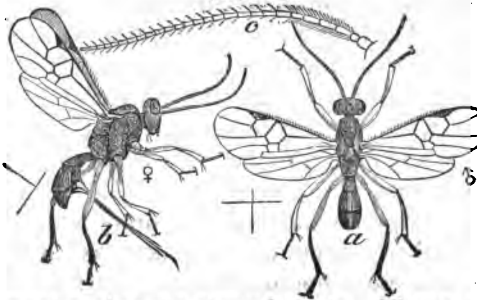
I have been urged to take an interest in two of these machines, and even to take out a patent for certain improvements suggested; but as a public officer I have refused to do either. My object is to give a disinterested and candid account of what I conceive to be the merits or demerits of any machine that may appear, in the hope that ere long we shall have something in the market, so cheap and efficient that no peach-grower will have any excuse for not jarring his trees.

TWO TRUE PARASITES OF THE PLUM CURCULIO.

THE SIGALPHUS CURCULIO PARASITE.

Just 10 years ago, in his "Address on the Curculio," delivered at the annual meeting of the N. Y. State Agricultural Society, Dr. Fitch gave an account, accompanied with a figure, of a small Ichneumon-

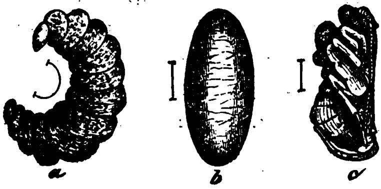
[Fig. 7.]



fly which he named *Sigalphus curculionis*, and which he believed was parasitic on the Curculio. Before that time no parasite had ever been known to attack this pestilent little weevil, and even up to the present time it is currently believed that no such parasite exists; for unfortunately the evidence given by Dr. Fitch was not sufficient to satisfy some of our most eminent entomologists. These parasites were in fact received by him from Mr. D. W. Beadle of St. Catherines, C. W., who had bred them from Black-knot, from which he bred at the same time a certain number of Curculios; but as other worms besides those of the Curculio are likewise found in Black-knot, we had no absolute proof that this fly was parasitic on the insect in question. Consequently we find that Mr. Walsh, in his Report as Acting State Entomologist of Illinois, rather ridicules the idea of its being a Curculio parasite and endeavors to prove that it is parasitic instead on the larva of his Plum Moth (*Semasia prunivora*). But I have this year not only proved that poor Walsh was himself wrong in this particular inference, but that he was equally wrong in supposing his little Plum-moth, so called, to be confined to plums; for I have bred it from Galls (*Quercus frondosa*, Bassett); from haws, from crab apples and abundantly from tame apples.

To be brief, Dr. Fitch's *Sigalphus* is a true parasite on the Plum Curculio and I have bred hundreds of the flies from Curculio larvæ. The first bred specimens gave me much pleasure, for as soon as I saw they belonged to the same genus as Dr. Fitch's fly, I felt assured that another disputed question was settled. But to make assurance doubly sure, I repeatedly half filled large jars with pure earth, finely sifted so that no living animal remained in it. Into these jars I placed Curculio larvæ from day to day as they issued from peaches that were thrown into another vessel, and in due time the parasitic flies began to issue from the ground along with the perfect Curculios. Nay more than this, I soon learned to distinguish such Curculio larvæ as were parasitised, and after they had worried themselves under the ground—seldom more than half an inch—I would uncover them, and on several occasions had the satisfaction of watching the gnawing worm within reduce its victim until finely nothing was left of him. As soon as the Curculio larva is destroyed by the parasite, the latter (Fig. 8, *a*) encloses itself in a tough little yellowish cocoon of silk (Fig. 8, *b*), then gradually assumes the pupa state (Fig. 8, *c*) and at the end of about the same length of time that the Curculio

[Fig. 8.]



requires to undergo *its* transformations and issue as a beetle, this, its deadly foe, gnaws a hole through its cocoon and issues to the light of day as a black four-winged fly (Fig. 7, *a male ; b female*). In the vicinity of St. Louis, this fly was so common the past season that after very careful estimates, I am satisfied three-fourths of all the more early developed Curculio larvæ were destroyed by it. On the 17th and 18th of April, in that locality a severe frost killed the peach buds on all but a few of the young and most vigorous trees of Hale's Early and Crawford, so that instead of a large and abundant crop of peaches to depredate on, the little Turk had to concentrate its attacks on the few peaches that were left; and no one expected that any fruit would be saved. Yet the work of this little parasite was so effectual that, wherever fruit set, a fair crop was gathered even by those who made no effort at all to protect their trees!

While visiting Dr. Fitch last August, at his house in Salem, N. Y., I compared my bred specimens with his species, and found them identically the same; but a full description of it will be found below, and it is not necessary at present to dwell upon its characters.

As Mr. Walsh bred this same parasite from the larvæ of his little Plum Moth, it doubtless attacks other soft-bodied larvæ and does not confine itself to the Plum Curculio. This is the more likely as it would scarcely pass the winter in the fly state. The female, with that wonderful instinct which is exhibited in such a surpassing degree in the insect world, knows as well as we great Lords of Creation what the little crescent mark upon a peach or plum indicates; and can doubtless tell with more surity, though she never received a lesson from her parents, whether or not a Curculo larva is drilling its way through the fruit. When she has once ascertained the presence of such a larva by aid of her antennæ—which she deftly applies to different parts of the fruit, and which doubtless possess some occult and delicate sense of perception, which, with our comparatively dull senses, we are unable to comprehend—then she pierces the fruit, and with unerring precision, deposits a single egg in her victim, by means of her ovipositor.

Now there is, as I shall show in the description, a variety (*rufus*) of this parasite, with the ovipositor nearly one-fifth of an inch long, but in the normal form the ovipositor is only twelve-hundredths of an inch long, and the Curculio larva must therefore be reached soon after it hatches, or while yet very young. Consequently we find that the earliest Curculio larvæ, or those which hatch while the fruit is yet small, are the most subject to be parasitised, and while from larva obtained early in the season, I bred more parasites than Curculios, this order of things was reversed a little later in the year. Some persons will no doubt wonder how such a large fly can be developed from a Curculio larva which is stung while so young; but we do not know how long the parasitic egg remains unhatched, and it must be remembered that it is a rule, wisely ordained and long known to exist in insect life, that the parasitic larva does not at first kill outright, but subsists, without retarding growth, upon the fatty portions of its victim, until its own growth is attained. Thus the first worm derives its nourishment from the juicy fruit, and grows on regardless of the parasite which is consuming its adipose substance, until the latter is sufficiently developed, and the appointed time arrives for it to destroy its prey by attacking those parts more vital.

This parasite, which I will now proceed to describe, belongs to the second sub-family (*Braconides*) of the Ichneumon-flies (*Ichneumonidæ*), and the venation of its wings, and 3-jointed abdomen, place it in the genus *Sigalphus*. Westwood (Synopsis, p. 63) gives three cubital panes or areolets in the front wings as characteristic of the genus; but Brullé (p. 510) and, as Mr. Cresson informs me, Westmael in his *Braconides de Belgique*, give only two, which is the number in our insect.

SIGALPHUS CURCULIONIS, Fitch—*Imago*—(Fig. 7, *a* male; *b* female). *Head* black, sub-polished and sparsely covered on the face with short whitish hairs; ocelli touching each other; labrum and jaws brown; palpi pale yellow; antennæ (Fig. 7, *c*) 27-jointed, filiform, reaching, when turned back, to middle joint of abdomen or beyond, the bulbus and small second joint rufous and glabrous, the rest black or dark brown, though 3–10 in many specimens are more or less tinged with rufous; 3–14 very gradually diminishing in size; 14–27 sub-equal. *Thorax* black, polished, the metathorax distinctly and broadly punctate, and the rest more or less distinctly punctate or rugose, with the sides sparsely pubescent. *Abdomen* pitchy-black, flattened, the dorsum convex, the venter concave, and the sides narrow-edged and slightly carinated; the three joints distinctly separated and of about equal length; the first joint having two dorsal longitudinal carinæ down the middle; all densely marked with very fine longitudinally impressed lines, and sparsely pubescent; (Dr. Fitch in his description published in the *Country Gentleman*, under date of September, 1859, states that these lines leave "a smooth stripe along the middle of its second segment and a large smooth space on the base of the third;" which is true of a few specimens, but not of the majority, in which the impressed lines generally cover the whole abdomen.) Ovipositor longer than abdomen, but when stretched in a line with it, projecting backwards about the same length beyond; rufous, with the sheaths black. *Legs* pale rufous, with the upper part of hind tibiæ aud tarsi, and sometimes the hind femora, dusky. *Wings* subhyaline and iridescent, the veins pale rufous, and the stigma black. Length ♀, 0.15–0.16 inch, expanse 0.30; ♂ differs only in his somewhat smaller size and in lacking the ovipositor. In many specimens the mesothorax and the eyes are more or less distinctly rufous.

Described from 50 ♀♀, 10 ♂♂, bred June 23d–July 29th, 1870, from larvæ of *Conotrachelus nenuphar*, and 2 ♀♀ obtained from Dr. Fitch.

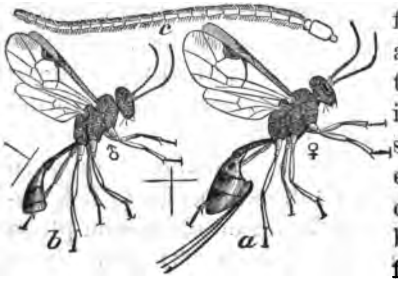
Larva (Fig. 8, *a*)—White, with translucent yellowish mottlings.

Pupa (Fig. 8, *c* ♀)—0.17 inch long; whitish, the members all distinct, the antennæ touching hind tarsi, the ovipositor curved round behind, reaching and touching with its tip the third abdominal joint, which afterwards forms the apical joint of imago; five ventral joints, which in the imago become much absorbed and hidden, being strongly developed.

Cocoon (Fig. 8, *b*)—Composed of one layer of closely woven yellowish silk.

VARIETY RUFUS—Head, thorax and most of first abdominal joint entirely rufous, with the middle and hind tibiæ dusky, and the ovipositor three times as long as abdomen and projecting more than twice the length of the same beyond its tip.

Described from three ♀♀ bred promiscuously with the others. This variety is slightly larger and differs so remarkably from the normal form that, were it not for the absolute correspondence in all the sculpturing of the thorax and body, and in the venation of the wings, it might be considered distinct. The greater length of the ovipositor is very characteristic, and accompanies the other variation in all three of the specimens.



[Fig. 9.]

The other parsite works in very much the same manner, but instead of issuing the same summer as a fly, it remains in its somewhat tougher and more yellowish cocoon all through the fall and winter, and does not issue in the winged state till the following spring. This parasite was first discovered by Dr. Trimble, who sent me the cocoons from which I subsequently bred the perfect fly. It belongs to the first sub-family (*Ichneumonides*) of the Ichneumon-flies, and apparently to the genus *Porizon** of which it forms a new species. It is only necessary here to state that it differs from the other species in its reddish-brown abdomen, as well as in form, as may be readily seen by referring to the figures (Fig. 9, *a* female; *b* male; *c* antenna).

PORIZON CONOTRACHELI, N. SP.—*Head* pitchy-black, opaque, the ocelli triangularly placed and close together; eyes oval, polished, and black; face covered with a silvery-white pubescence; labrum rufous, with yellowish hairs; mandibles and palpi, pale yellowish-brown; antennæ inserted in depressions between the eyes, reaching to metathorax when turned back, filiform, 24-jointed; black with basal joints 6–1 becoming more and more rufous, the bulbus always distinctly rufous; bulbus rather longer and twice as thick as joint 3; joint 2 about one-third as long. *Thorax* pitchy-black, opaque, the sides slightly pubescent with whitish hairs, the mesothorax rounded and bulging anteriorly, the scutellum slightly excavated and sharply defined by a carina each side; metathorax with the elevated lines well defined and running parallel and close together from scutellum to about one-fourth their length, then suddenly diverging and each forking about the middle. *Abdomen* glabrous, polished, very slender at base, gradually broader and much compressed from the sides at the apex which is truncated; peduncle uniform in diameter and as long as joints 2 and 3 together; joints 2–5 subequal in length; color rufous with the peduncle wholly, dorsum of joint 2, a lateral shade on joint 3, and more or less of the two apical joints superiorly, especially at their anterior edges, black; venter more yellowish: ovipositor about as long as abdomen, porrect when in use, curved upwards when at rest, rufous, with the sheaths longer and black. *Legs,* including trochanters and coxæ uniformly pale yellowish-brown with the tips of tarsi dusky. *Wings* subhyaline and iridescent, with veins and stigma dark brown, the stigma quite large, and the two discoidal cells subequal and, as usual in this genus, joining end to end, but with the upper veins which separate them from the radial cell, slightly elbowed instead of being straight, thus giving the radial cell a quadrangular rather than a triangular appearance. ♂ differs from ♀ only in his somewhat smaller size and unarmed abdomen. Expanse ♀ 0.32 inch, length of body, exclusive of ovipositor 0.22; expanse ♂ 0.28, length 0.18.

Described from 3 ♀ ♀, 1 ♂ bred May 26th–28th, 1870, from cocoons received from Dr. I. P. Trimble, of New Jersey, and 1 ♀ subsequently received from the same gentleman—all obtained from larvæ of *Conotrachelus nenuphar.*

"But of what use are these parasites?" say you! Well, they can not, it is true, be turned to very practical account, because they are not sufficiently under our control; but it is a source of great satisfaction to those who have been looking for many years for some natural aid to help them in the artificial warfare waged against the Curculio, to know that besides its several cannibal foes, there are at last two true parasites which attack it. Indeed, with the knowledge of the Curculio enemies figured and described two years ago in the *American Entomologist*, and of the egg-destroying *Thrips* which I mentioned last year in a paper published in the Illinois State Horticultural Transactions for 1869 (p. 90), and these two parasites, the grower of our luscious stone-fruits may with good reason begin to hope for better days, for the prospect brightens. There is no philosophy in the statement of Mr. W. B. Ransom,* that we can never hope for assistance from parasites, because, as he confidently expresses it, "there are none at present but what have always existed!" Such argument will do for the believers in the old-school doctrine, that every thing was created just as we find it; but not for those who rightly comprehend the Darwinian hypothesis of development, and who believe that life is slowly undergoing change and modification to-day just as it ever has since it had an existence on this Earth. For my own part, nothing has ever appeared more absurd than the direct creation of something out of nothing, and I would as soon believe that we all dropped full grown from the clouds—instead of being brought into the world by natural means and gradually developing into manhood and womanhood—or that we have the same habits as our barbarous ancestors had; as to believe that the animal life about us is now as it was in the beginning! Therefore, though these Curculio parasites may have existed in this country long ere the white man first beheld its shores, yet they may only have acquired the habit of preying upon the Curculio within the last comparatively few years. Moreover, much benefit may be derived from their artificial propagation and dissemination, and—utopian as the scheme may appear—I intend next year, *Deo volente*, to breed enough of the first mentioned species to send at least a dozen to every county seat in the State, and have them liberated into some one's peach orchard.

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* As I am informed by Mr. E. T. Cresson, of Philadelphia, who pays especial attention to the classification of the *Ichneumonidæ,* it might more properly be referred to Holmgren's genus *Thersilochus,* which differs from *Porizon* in the greater distance between the antennæ at base, and in the venation of the wing.

THE APPLE CURCULIO.—*Anthonomus quadrigibbus*, Say.

"Prove all things; hold fast that which is good!"

This injunction of St. Paul applies with just as much force to us to-day, as it did in centuries past to the Thessalonians. In what has been said above about the Plum Curculio, we have had abundant opportunity of testing the soundness of the old proverb, and in ascertaining the history of the Apple Curculio, which I am about to give, it was very necessary to bear the advice in mind. It often takes years to undo the assertions of men who are in the habit of talking glibly of that which they really know nothing about, and I ought to comment severely on what has been said about this insect; but I refrain from doing so, in this case, lest it be said that my words are prompted from personal considerations.* I shall therefore content myself with a plain narrative of this insect's habits.

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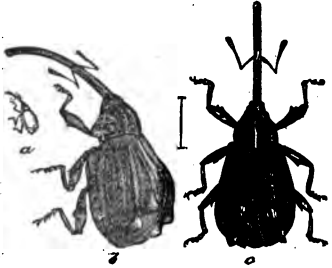
* *Prairie Farmer*, June 4th, 1870.

First then, let us explain the differences between the perfect states of this insect and the Plum Curculio, that any one may distinguish between them.

The snout of the Plum Curculio hangs down like the trunk of an elephant; it is short, stout, and does not admit of being stretched out horizontally forwards; and as may be seen by referring to the figure (Fig. 1, *c*) is scarcely as long as the head and thorax together, and can be folded back between the legs, where there is a groove to receive it. The Plum Curculio is broadest across the shoulders and narrows behind, and moreover, the black sealing-wax-like, knife-edged elevations on the back, with the pale band behind them, characterize it at once from all our other fruit boring snout-beetles.

[Fig. 10.]



The Apple, or Four-humped Curculio (Fig. 10, *a*, natural size; *b*, side view; *c*, back view,) is a smaller insect with a snout which sticks out more or less horizontally and can not be folded under, and which in the male is about half as long, and in the female is fully as long as the whole body. This insect has narrow shoulders and broadens behind, where it is furnished with four very conspicuous humps, from which it takes its name. It has neither the polished black elevations nor the pale band of the Plum Curculio. In short, it differs generically, and never attacks stone fruit.

The size varies from 1-20th to nearly 1-12th of an inch, but the colors are quite uniform, the body being ferruginous or rusty-brown often with the thorax and anterior third of the wing-covers ash-gray —the thorax having three more or less distinct pale lines.

ITS NATURAL HISTORY.

This beetle like the Plum-weevil is a native American insect, and has from time immemorial fed on, and bred in, our wild crabs. It is also commonly met with on the Thorn, and Mr. Wm. Saunders, of London, C.W., tells me that though abundant on the last named tree, it has not yet learned to attack the apple in his locality. It eventually learned to like our cultivated apples and pears, and is also found on quinces. At present it does considerable damage to the crop in some localities, though it yet prefers the wild to the cultivated fruit. Like the Plum-weevil also, it is single-brooded, and winters over in the beetle state, though I was led to believe differently a year ago. With its long thin snout it drills holes into the fruit, much resembling the puncture of a hot needle, the hole being round, with a more or less intense black annulation. and an ash-gray centre. Those holes made for food are about one-tenth of an inch deep and generally scooped out broadly at the bottom in the shape of a gourd. Those which the female makes for her eggs are scooped out still more broadly and the egg at the bottom is often found larger than the puncture at the orifice —thus indicating that it swells from absorption, by a sort of endosmosis, of nutritive fluid from the surrounding fruit, just as the eggs of many saw-flies and of some other snout-beetles are known to do.

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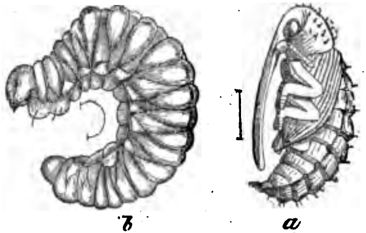
* My views on this subject, with comments on what has been said about this insect, may be found in a controversy, in articles published in the *American Entomologist and Botanist*, Vol. II, pp. 225–7 and 268–71; the *Prairie Farmer*, July 16th, 23d and Aug. 27th, 1870; and the *Journal of Agriculture*, Oct. 13th, and Nov. 10th and 17th, 1870.

The egg is fully 0.04 of an inch long, nearly oval, not quite three times as long as wide, and of a yellowish color, with one end dark and empty when the embryo larva is well formed. The egg-shell is so very fine that the larva seems to gradually develop from it instead of crawling out of it; and by taking a matured egg and gently rolling it between the thumb and finger, the young larva presents itself, and at this early age its two little light brown mandibles show distinctly on the head. As soon as this larva hatches it generally goes right to the heart of the fruit and it feeds there around the core, producing much rust-red excrement, and acquiring a tint of the same color. It feeds for nearly a month, and when full grown presents the appearance of Figure 11, *b*.

[Fig. 11.]



It differs so remarkably from that of the Plum Curculio that the two insects can be distinguished at a glance even in this masked form. It is softer, the chitinous covering being thinner and much whiter. It cannot stretch straight and travel fast as can that of the Plum Curculio, but curls round with an arched back, joints 4–7 being larger than the preceding. It is more crinkled, each joint being divided into three principal folds much as in the common White Grub. The space between the folds is frequently bluish-black, and there is a very distinct, continuous, vascular, dorsal line of a bluish color. It has no bristles like *nenuphar* except a few weak ones on the first joint, arising from some ventral tubercles which remind one of feet. The head is yellowish-brown with the jaws somewhat darker, and the breathing pores, except that in the fold of the first joint, are not easily seen.

IT TRANSFORMS IN THE FRUIT.

The fruit of the wild crab containing this larva never falls, and the fruit of our cultivated apples seldom; and in this respect the effect of its work differs remarkably from that of the Plum Curculio, or even of the Codling Moth. Why such is the case it would be difficult to explain! It is one of those incomprehensible facts which at every turn confront the student of Nature's works. We might with equal reason ask why it is that of the two stone fruits, the plum and the cherry, the larger falls and perishes and the smaller hangs on and lives, when infested with the Plum Curculio; and of the two pomaceous fruits, the apple and the haw, the larger likewise falls and perishes and the smaller hangs on and lives, when infested with similar larvæ? Most persons would naturally infer that the larger instead of the smaller fruits would best resist the injurious gnawings of the worm within; and though we may explain away the paradox by supposing that the longer stem of the smaller fruits prevents the injury from reaching its juncture with the branch, so readily as it does through the shorter stem of the larger fruits; or that the greater weight of the larger fruit causes it to fall so readily; yet this is only assuming, and I doubt whether the vegetable pathologist will ever be able to show the peculiarities of the fruits which cause the different effects.

The larva of the Apple Curculio has no legs and is so humpbacked that it cannot stretch out, and would cut a very sorry figure in attempting to descend the tree. Therefore, as the fruit containing it mostly hangs on the tree, the insect is effectually imprisoned. But Nature's ways are always ways of wisdom and her resources are inexhaustible! Consequently we find that instead of having to go under ground to transform, as does the Plum Curculio, the normal habit of our Apple Curculio is to transform within the fruit. The larva, after becoming full fed, settles down in a neat cavity, and soon throws off its skin and assumes the pupa state, when it appears as at Figure 11, *a*. After remaining in this state from two to three weeks it undergoes another moult and the perfect beetle state is assumed. We thus see that the Apple Curculio is cradled in the fruit in which it was born till it is a perfect beetle, fully fledged, and ready to carry out the different functions and objects of its life. In other words, it never leaves the fruit, after hatching, till it has become a perfect beetle. This fact I have fully tested by breeding a number myself both from infested crabs which I collected, and from cultivated apples, also infested, that were kindly forwarded to me by Mr. J. B. Miller, of Anna, Illinois. I learn also from Mr. George Parmelee of Old Mission, Michigan, that he has satisfied himself of the same trait in the natural history of this insect, and I fully convinced myself that such was the normal habit, by repeatedly removing the full grown larva from the fruit and placing it on the surface of the ground, when, in every instance, it would make no attempt to bury itself, but would always transform on the surface.

THE AMOUNT OF DAMAGE IT DOES.

The observations that I have been able to make on this insect's work in our cultivated orchards are limited, but I think that it attacks with equal relish both summer and winter apples. Whenever a beetle has perfected in the fruit, it cuts quite a large hole for its escape, and these holes are sufficiently characteristic to enable one who has paid attention to the matter to tell with tolerable certainty whether an apple has been infested with Apple-worm, Plum Curculio, or Apple Curculio—even after the depredator has left.

In the southern portion of Illinois and in some parts of Missouri this insect is very abundant and does much damage to the apple crop; it occurs in greater or less numbers in most States of the Union, but in other localities again its work is scarcely ever seen, and I am satisfied that the damage it does has been much overrated. We can only judge of the future by the past, and though we may expect this insect to increase somewhat with the increase of our orchards, it is folly to suppose that it can go on increasing in geometrical ratio; and the pretty mathematical calculations which are intended to alarm the cultivator at the gloomy prospects of the future, are never made by those who understand the complicated net-work in which every animal organism is entangled, or who rightly understand the numerous influences at work to keep each species within due bounds. Such figures look well on paper, but, like air-castles, there is nothing real about them.

Our apples suffer much more, in many localities, from the gougings of the perfect beetle and the burrowings of the larva of the Plum Curculio, than they do from the work of this Apple Curculio; and this was so much the case in my own locality the past summer, that I found a dozen larvæ of the former in apples, where I found one of the latter.

At the late meeting of the Illinois State Horticultural Society, Mr. E. Daggy, of Tuscola, Illinois, had on exhibition some pears that were very much deformed and gnarled. This injury had been caused by the Apple Curculio, which Mr. Daggy recognized from figures and specimens which I had with me. Upon examining the pears I found a little dark circular spot which indicated distinctly where the snout of the beetle had been inserted. This spot was the center of a hard and irregular but generally rounded knot or swelling, which was sunk in a depression of the softer parts of the pear, thus indicating that the growth, by some property of the puncture, was checked and hardened, while the other parts went on growing and swelling. Some of the fruit was so badly disfigured that it could no longer be recognized, and Mr. Daggy informed me that his Vicar of Winkfield, Bergamott and "Sugar" pears were most affected in this way, and that his Duchesse pears were unblemished.

While the fruit is growing these punctures, in almost every instance, cause just such calloused spots and deformities as those des cribed above, but when the fruit is ripe they have a far more pernicious effect, for they generally cause the fruit to rot. It is now a well established fact that the common Plum Curculio causes the dreaded rot in peaches, plums, etc., to spread at a fearful rate by the punctures and gougings which it makes on the ripening fruit; and that where this predisposing influence is guarded against, such rot is generally confined to comparative narrow limits or does not occur at all. Many varieties of apples are disposed to rot in a similar manner, and to fall from the tree just as they are ripening. This rot in apples, as may be seen from the transactions of our State Horticultural Society, was very prevalent last fall—the Rawles Janet being especially predisposed to it—and there can be no doubt but that the punctures and gnawings of the little Turk, combined with those of the Apple Curculio are likewise the pricipal agents in producing it; for I have over and over again noticed the rot to spread in a circle from these punctures, not only on hanging fruit but just as invariably upon fruit punctured after it was plucked. Whether we believe that the fungus growths, often noticeable on such rotting fruit, are the direct result of the punctures, or that the latter only act indirectly by furnishing a proper nidus for the infectious fungus-spores which are supposed to be ever floating in the atmosphere, is a question which I shall not now stop to consider, though I have my own views which are somewhat heterodox. In either case, the Curculios are just as much to blame, and this should be an additional incentive to a general warfare upon them. Judge A. M. Brown, of Villa Ridge, has noticed that some varieties of apples are much more subject to rot and also more subject to the attacks of Curculios than others,* and it is to be hoped that he will make further observations and give us a reliable list of such varieties, and that other fruit-growers will do the same.

THE SEASON OF THE YEAR DURING WHICH IT WORKS.

The beetles come from their winter quarters and begin to work on the fruit at about the same time as does the Plum Curculio—if anything, a little later. They have generally got fully to work, and larvæ may be found already hatched by the first of June, and they may be found in the fruit, in one stage or another, all along through the months of June and July and the greater part of August.

REMEDIES AND PREVENTIVE MEASURES.

Notwithstanding we have had reports, published in the columns of our agricultural papers, of the relative number of Apple and Plum Curculios captured from peach trees by jarring with the Curculio-catcher, I am fully convinced that such reports were not based on facts, and that we may never expect to subdue this insect by the jarring process. It is not as timid or as much inclined to drop as the Plum Curculio, and though it can occasionally be brought down, it generally remains defiantly on the fruit or on the bough, through the gentlest as well as the severest jarring of the tree. Indeed, its habit of transforming in the fruit, places it in a great measure beyond our control, and I fear that this is one of the few insects with which we can do but little by artificial means. But we have only just commenced to understand this foe, and there is much yet to learn about it. I sincerely hope that the few facts which have been here given, will increase the reader's interest in this insect and enable him to carry on future observations and experiments with a better understanding; so that they will at last result in making us masters of this rather difficult situation. Mr. H. Lewelling, of High Hill, Montgomery county, Missouri, who has had much of his fruit injured by this insect, informs me that Tallman's Sweet is preferred by it to all other varieties, and our observations should, as much as possible, tend in the direction of deciding which varieties are most subject to, and which most exempt from its attacks; and which varieties fall most readily when infested by it. For it is obvious that with our present knowledge, the only real remedy which yet exists, is the destruction of the infested fruit, whether upon or off the tree; and it may turn out that although we cannot jar down the beetles, we can jar down much of the infested fruit, which would, without jarring, remain on the trees.

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*Prairie Farmer, January 28, 1871.

ANTHONOMUS QUADRIGIBBUS, Say—*Larva* (Fig. 11, *b*)—Average dorsal length when full grown 0.45 inch; soft and white, with a very few sparse soft hairs; arched and wrinkled Lamellicorn-fashion, the space between the wrinkles, and a distinct dorsal vascular line, bluish-black. Head free and almost perpendicular, yellowish-brown with the mandibles darker. A pair of polished ventral tubercles on each of the three thoracic joints, and each bearing a distinct bristle.

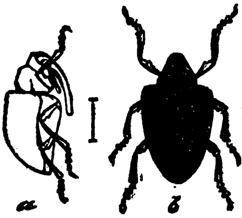
Pupa (Fig. 11, *a*)—Average length 0.40 inch. Whitish, the snout of ♀ reaching beyond tip of wing-cases, that of ♂ not much beyond the elbow of middle femora and tibiæ. Thorax with a few short stiff hairs springing from slight conical elevations. Wing-cases showing the striæ and humps of future beetle, the tip of the upper case usually terminating in a thorn. The nine abdominal joints deeply and distinctly separated, the first showing a rounded scuttellar turbercle; the sides angular, conically ridged and armed on each joint with two brown thorns or bristles, which become stouter towards apex; a transverse dorsal row of about eight similar bristles on the posterior sub-margin of each joint, also becoming larger towards apex: Terminal subsegment ending in *one* stout, slightly curved, thorn.

THE QUINCE CURCULIO—*Conotrachelus cratægi*, Walsh.

HOW IT DIFFERS FROM THE OTHERS.

This insect has been called the Quince Curculio by Dr. Trimble, and though it breeds in other fruits, the name is a good one as it will enable us to distinguish it at once from our other fruit snout-beetles. I have had the beetle in my cabinet for several years, but knew nothing of its larval history till a year ago last fall. It breeds very abundantly in our common haws, and I raised a number of them the present season from the fruit of the Pear or Black Thorn (*Cratægus tomentosa*) obtained from Mr. Walsh.

[Fig. 12.]



Though belonging to the same genus as our Plum Curculio, and having very much the same form, as may be seen by referring to the figure, (Fig. 12, *a* side view; *b* back view), yet it differs remarkably in its habits from both of the preceding weevils. It is, like them, an indigenous species, and its original fruit was evidently the wild Haw, which in the West it yet seems to prefer to the cultivated fruits. But in the East it has become very injurious to the Quince and, as we might naturally expect, also attacks the Pear, and especially the Lawrence and other late varieties. In September, 1868, I received specimens from W. W. Sweet, of Highstown, N. J., with the statement that they were found on pears, and Dr. Trimble at a late meeting of the New York Farmers' Club (Oct. 22, 1870), gave the following account of its injuries in New Jersey the present year:

> "Yesterday five or six hundred were taken from the bottoms of two barrels of quinces, although those quinces had only been gathered four days before. A friend of mine has a quince orchard of 286 trees. These trees this season should average seventy or eighty quinces to a tree, making more than twenty thousand. Upon a most careful search I was unable to find one specimen perfect, or clear of one or more blemishes caused by the punctures of this insect. Frequently four, five, or six grubs will be found in a single quince. Mr. Goldsmith, the owner, keeps this orchard in first-rate order; he has faithfully kept out the borers, so fatal to the quince trees; has fertilized very freely, and the cultivation is perfect. He told me yesterday, that his crop this year is thirty barrels, which will yield him about $125. Had this insect let him alone he should have had at least 100 barrels, worth $800 to $1,000. Many of his later pears, including the Seckel and Lawrence, have suffered greatly, though not to the same extent as his quinces. A few days ago he emptied a barrel of cullings, chiefly Lawrence pears, and in and near the bottom of that barrel were found at least 400 of these grubs. A month ago I visited the orchards attached to one of the best nurseries in Pennsylvania, and I found the sad evidence of the presence of this enemy. Even the Seckel pears, though very abundant, were almost worthless; later varieties still worse. Mr. Fuller tells me that he has seen this season, in Western New York, the same condition of fruit at a well known nursery, even the Duchesse pears almost totally destroyed. This fruit enemy seems yet confined to localities; but is spreading rapidly."

This beetle was first very briefly described by Mr. Walsh in a note in the *Prarie Farmer* for July 18th, 1863, p. 37, from specimens found by him on the hawthorn, but until I bred it this spring, nothing was known of its larval history. It is a somewhat larger insect than the Plum Curculio, has a comparatively longer snout, and is very broad-shouldered; thus tapering just the opposite way to the Apple Curculio. Its general color is a tolerably uniform ash-gray, mottled more or less with ochre-yellow, dusky and whitish, and it has a dusky somewhat triangular spot at the base of the thorax above, and seven distinct narrow longitudinal elevations on the wing-covers, with two rows of punctures between each.

This beetle differs further from the others, in the fact that it does not appear, even in the latitude of St. Louis, till about the first of June, and I have had its larvæ of the previous year in the ground in May, when the newly hatched larvæ of the Plum Curculio were already working destruction in the fruit. In some of the more northern States it would not appear till the middle of July.

ITS TRANSFORMATIONS AND HABITS.

This snout-beetle does not make a crescent like the Plum Curculio; but, like the Apple Curculio, makes a direct puncture for the reception of its egg, the hole being somewhat larger than that of the latter, and the bottom of the cavity similarly enlarged and gnawed, so as to form a neat bed for the egg. The egg is very similar to that of the Plum Curculio, and hatches in a few days after being deposited. In all probability it also swells and enlarges somewhat before hatching. The larva works for the most part near the surface of the fruit, and does not enter to the heart. It is of the general form of that of the Plum Curculio, and differs principally in being somewhat larger, more opaque-white, and in having a narrow dusky dorsal line and a distinct lateral tubercle on each joint. When full grown, which is in a month or more from the time of hatching, it leaves the fruit through a smooth cylindrical hole and burrows two or three inches into the ground. Here, singularly enough, it remains all through the fall, winter and spring months without changing—no matter whether it left the fruit as early as the first of August or as late as the first of October. This is the peculiar feature of the insect, namely, that it invariably passes the winter in the larva state, and does not even assume the pupa state till the fore part of May, or a few days before issuing as a beetle. In this respect it resembles the nut-weevils which infest our hickory-nuts, hazel-nuts and acorns. In higher latitudes than that of St. Louis, there is evidence that some of the late hatched larvæ do not leave the haws they infest till frost overtakes them, but pass the winter within the fruit as it lies on the frozen ground. The pupa differs only from that of the Plum Curculio in the greater length of the proboscis.

I have already referred to the fact that Dr. Fitch supposed the Plum Curculio to be two-brooded, and those who have read his "Address" on this insect will readily perceive that he based his opinion on finding what he took to be its larvæ in the tender bark of a pear twig late in the fall, and on finding what he similarly mistook for such larvæ in haws in winter. Of course, we know positively now that the Plum Curculio does not so breed in pear twigs, and it is very evident that what Dr. Fitch took to be Plum Curculio larvæ in such a twig, were the young of some other insect, or perhaps even the eggs of some leaf-hopper (*Tettigonia*), which are generally placed in the position described by him. But, though this first error of Dr. Fitch's has been explained away, the second never has till now, when we may assume, with great reason, that the larvæ which misled the Doctor, and which were found in haws in winter time, were in reality the larvæ of our Quince Curculio. How easily are fallacies exploded, and errors corrected, even years after they are committed, by a few well tested facts!

The two former Curculios which we have been considering have a beetle existence of between nine and ten months, during most of which time, or as long as the weather is sufficiently mild, they feed in the manner described. The present species has a beetle existence of not more than two months, and as though aware of the short term allotted to it for enjoyment, it endeavors to make the best use of its time. Consequently we find it more ravenous than either of the other species, and it is really astonishing how much this insect eats. It excavates immense holes for food, often burying itself in them completely, and I have known apples furnished to these beetles in confinement, to have their substances so completely devoured that nothing but the rind was left. Two years ago last fall there was scarcely a quince that came into the St. Louis market that was not marred by numbers of large gougings, and though I was then inclined to attribute such holes to the gnawings of grasshoppers, I feel pretty well convinced at present that the work might with more justice have been attributed to this Quince Curculio.

The question will naturally arise, since this insect breeds in the Haw, the Quince and the Pear, whether it will also breed in the closely allied Apple? So far as my experiments go, they indicate clearly that it will not; for although the beetle will eat and greatly disfigure apples, when no other nourishment is at hand, yet a number which I confined to a large branch of an apple tree on the 14th of June last, absolutely refused to deposit eggs, and died three weeks afterwards.

REMEDIES.

Very fortunately this insect drops as readily when alarmed as does the Plum Curculio, and the jarring process will be found just as effectual in catching it, with the additional advantage that the jarring need only be carried on for about ten weeks of the year, namely, from about the first of June to the middle of August in this latitude. Moreover, in accordance with its late appearance, we find that, according to Dr. Trimble, whenever it attacks pears, it prefers the late ripening varieties. Again, it is, like the Plum Curculio, nocturnal in its habits, and secretive during the day, so that the Ransom process will undoubtedly prove effectual with it, if used at the right season. All fruit that falls should be destroyed, and as we know that the larva hibernates in the ground, many of them will be injured and destroyed by late stirring of the soil.

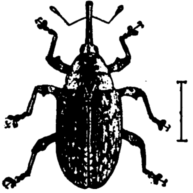
CONOTRACHELUS CRATÆGI, Walsh—*Larva*—Average length when full grown 0.32 inch; 4½ times as long as wide, and straight. Opaque whitish, with a narrow dusky dorsal line, generally obsolete on thorax, and a few very short hairs. Distinct lateral tubercles on all the joints. Head rufous with mandibles black, except at base, and distinctly two-toothed at tip.

Pupa—Average length 0.28 inch. Snout reaching a little beyond elbow of middle tibiæ and tarsi, with two stout rufous thorns near the origin of antennæ, two more at base and sometimes others more toward the tip. Head and thorax also armed with such thorns, and also two to each elbow of the femora and tibiæ. Wing cases with rows of short rufous bristles along the elevations between the striæ. Abdomen cylindrical, the basal joint with a central scutellar bristleless tubercle and two others, one each side of it, each bearing a bristle; the other joints conically tubercled, laterally, each tubercle bearing a stout bristle, and each joint bearing dorsally about four other bristles on its posterior sub-margin. Terminal sub-segment squarely cut off and bearing *two* stout inwardly-curved brown thorns.

THE PLUM GOUGER.—*Anthonomus prunicida*, Walsh.

ITS CHARACTER, DISTRIBUTION, AND FOOD.

[Fig. 13.]



This name was given by Mr. Walsh to another indigenous weevil which is represented enlarged in the accompanying illustration (Fig. 13). It is easily distinguished from either of the preceding weevils, by its ochre-yellow thorax and legs, and its darker wing-covers, which are dun-colored, or brown with a leaden-gray tint, and have no humps at all. Its snout is not much longer than the thorax, but as in the Apple Curculio, projects forwards, or downwards but cannot be bent under as in the Plum Curculio. This insect was first described in the *Prairie Farmer* for June 13th, 1863, and the description was afterwards republished in the Proceedings of the Boston Society of Natural History for February, 1864.

Mr. Walsh gave such a good account of it in his report as Acting State Entomologist of Illinois, that it is unnecessary for me to go into detail, and I will therefore only briefly allude to those traits in its history which are well established.

The Plum Gouger seems to be unknown in the Eastern States, or at least is not common there; but it is very generally distributed throughout the Valley of the Mississippi. As a rule it is much less common and does much less injury than the little Turk, though in some few districts it is found equally abundant, and I received specimens on the first of June last, from my esteemed correspondent Mr.

Huron Burt, of Williamsburg, Callaway county, Mo., with the statement that it was doing great damage to the plums in that locality, though the little Turk was scarcely met with. There is a plum known there as "Missouri Nonsuch" which, though said to be Curculio proof, is worked upon very badly by the Gouger.

The Plum Gouger is often found on wild crab trees, and may, like the Plum Curculio, occasionally deposit and breed in pip fruit; but it is partial to smooth-skinned stone-fruit such as prunes, plums, and nectarines, and it does not even seem to relish the rough-skinned peach.

OFTEN MISTAKEN FOR THE PLUM CURCULIO.

It has often been confounded with the Plum Curculio, and was once supposed by my friend L. C. Francis, of Springfield, Ills., to be the male of that species. We all have a right to suppose what we please, and as long as our suppositions are not thrust on the public for ascertained facts, they can do no possible harm. But Mr. J. P. Williamson, of Des Moines county, Iowa, is not satisfied with supposing this or some other straight-snouted weevil, to be the female of the Plum Curculio, but, in a last summer's issue of the *Prairie Farmer*, not only emphatically speaks of it as such, but, finding that these supposed females frequent the trees two weeks earlier than the males, (?) he concludes for some unexplained reason, that the sole object of visiting the fruit is for the deposition of eggs; and straightway hatches the theory that the Plum Curculio can do no harm till the males appear! Consequently, instead of jarring our trees as long as fruit remains on them, we are informed by Mr. Williamson that it is only necessary to jar them about six weeks.

And thus it always is with men who do not sufficiently understand the absolute importance of care and caution in reading Nature's secrets: from supposition to assumption; from assumption to theory; from theory to advice, which—it is unnecessary here to say—is of a most pernicious character.

ITS TIME OF APPEARANCE.

This beetle appears in the spring about the same time as the Plum Curculio, but as no eggs are deposited after the stone of the fruit becomes hard, and as its larva requires a longer period to mature than that of the latter, its time of depositing is shorter, and the old beetles generally die off and disappear before the new ones eat their way out of the fruit, which they do during August, September, and October, according to the latitude.

ITS NATURAL HISTORY.

Though we have no absolute proof of the fact, analogy would lead us to believe, and in my own mind there is no doubt, that this insect passes the winter in the beetle state, and that it is, like the other species, single-brooded. Both sexes bore cylindrical holes in the fruit for food, and these holes are of the exact diameter of the snout, and consequently somewhat larger than those of the Apple Curculio. These holes are broadened at the bottom, or gouged out in the shape of a gourd; and especially is this the case with those intended by the female for the reception of an egg. The egg, in this case also, enlarges from endosmosis, and it is probable that all weevils that make a puncture for the reception of their eggs, gnaw and enlarge the bottom, not only to give the egg room to swell, but to deaden the surrounding fruit, and prevent its crushing such egg—the same object being attained by the deadened flap made by the crescent of the little Turk. Wherever this insect abounds, plums will be found covered with its holes, the great majority of them, however, made for feeding purposes. The gum exudes from each puncture, and the fruit either drops or becomes knotty and worthless.

The young larva which hatches from the egg, instead of rioting in the flesh of the plum, or remaining around the outside of the kernel, makes an almost straight course for that kernel, through the yet soft shell of which it penetrates. Here it remains until it has become full-fed, when by a wise instinct it cuts a round hole through the now hard stone, and retires inside again to change to the pupa and finally to the beetle state. When once the several parts of the beetle are sufficiently hard and strong, it ventures through the hole which it had already providently prepared for exit with its stronger larval jaws, and then easily bores its way through the flesh and escapes.

It must not be forgotten that, while the kernel of the fruit is yet soft, the larva of the little Turk often penetrates and devours it; but in this case the soft stone is more or less reduced to reddish powder, whereas the larva of the Plum Gouger enters the stone and feeds on the inside while the outside hardens. The normal habit of the former is to feed on the outside; that of the latter on the inside of the stone.

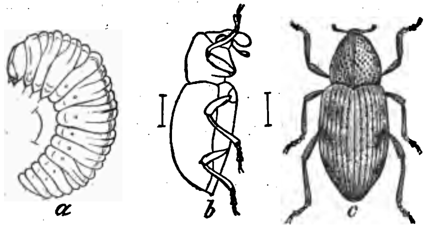
REMEDIES.

This Plum Gouger is about as hard to deal with as the Apple Curculio. It drops almost as reluctantly and we therefore cannot do much by the jarring process to diminish its numbers. Moreover it takes wing much more readily than the other weevils we have mentioned; and though fruit that is badly punctured for food, often falls prematurely to the ground, yet, according to Mr. Walsh, that infested with the larva generally hangs on the tree until the stone is hard and premature ripening sets in. In all probability the stunted and prematurely ripened fruit containing this insect will jar down much more readily than the healthy fruit, but I have so far had no opportunity of making any practical observations myself, and must conclude by hoping that our plum-growing members will make the proper experiments and give us the results.

THE STRAWBERRY CROWN-BORER.—*Analcis fragariæ* N. sp.

This is another indigenous insect, which seems to be confined to our Mississippi Valley, for I have heard no complaints in any of the Atlantic States, of injuries that could be attributed to this weevil. In the *Maine Farmer* for July 25th, 1867, we find a brief reference, made by Mr. G. E. Brackett of Belfast, Me., in answer to a certain "E. B.," of a "worm that eats into the crown of the plant and kills it." The worm referred to was, in all probability, the Crown-borer under consideration, but as no postoffice address of the questioner is given, the paragraph might just as well never have been written, for any light that it throws on the distribution of the insect. However, no such insect has ever been mentioned by our Eastern writers on the Strawberry, and we must necessarily conclude that it does not exist in the Atlantic States.

[Fig. 14.]



This insect has done considerable damage to the strawberry crop in the southern portion of Illinois, especially along the line of the Illinois Central Railroad; and I have seen evidence of its work in St. Louis county, Mo. At the meeting of the Southern Illinois Fruit Growers' Association, held at South Pass, in November, 1867, several complaints were made by parties from Anna and Makanda, of a white worm which worked in the roots of their strawberries and in 1868, the greater portion of the plants of a ten-acre field at Anna, belonging to Mr. Parker Earle, was destroyed by it.

In the fall of 1869 I had some correspondence with Mr. Walsh on this insect, and learned that he had succeeded in breeding it to the perfect state; and had it not been for his untimely death, its history would no doubt have been published a year ago. Through the kindness of Jos. M. Wilson, of Sterling, Whiteside county, and of J. B. Miller, of Anna, Union county, Ills., I received during the past year specimens of the larvæ, from which I succeeded in rearing the perfect beetle. It is therefore by the aid of these gentlemen, and especially from the experience of Mr. Miller, that I am enabled to give the above illustrations (Fig. 14) of the Strawberry Crown-borer, and the following necessarily imperfect account of its mode of working. I give them in the hope that they will prompt further investigation, and serve as a clue to enable others who have opportunity, to increase our knowledge of this pest; for there is much yet to learn of its habits, and consequently of the best means of fighting it.

From the middle of June to the middle of July in Southern Illinois, and later further north, the larva hatches from an egg which, in all probability, is deposited in the crown of the plant, and it immediately commences to bore its way downwards, into the pith. Here it remains till it has acquired its full size, working in the thick bulbous root and often eating through the more woody portions; so that when frost sets in, the plant easily breaks off and is heaved out of the ground. When full grown it presents the appearance of Figure 14, *a*, being a white grub with arched back and tawny-yellow head, and measuring about one-fifth of an inch when stretched out. It undergoes its transformations to the pupa and perfect beetle states within the root, and the latter makes its appearance above ground during the month of August.

The beetle (Fig. 14, *b* side view; *c* back view) is about 1-6th of an inch in length, of a chestnut-brown color, and marked and punctured as in the figure.

From analogy we may infer that the beetle feeds on the leaves of the strawberry, for it is a very general rule with snout-beetles, that the perfect insects feed on the leaves of such plants as they infest in the larva state. But whether it lives on through the winter as a beetle and does not commence depositing eggs again till the following June; or whether it is double-brooded and produces a second lot of larvæ which pass the winter in the roots, are questions which are not yet decided; and until we get a more comprehensive knowledge of this insect's ways and doings, we shall be in a measure powerless before it. From all the facts that can be obtained, the first hypothesis is the correct one, and in that event we can, in an emergency, easily get rid of this pest by plowing up and destroying the plants soon after they have done bearing, or say about the latter part of June in the latitude of St. Louis. By doing this the whole brood of borers will perish with the plants. Most strawberry-growers renew their plants, in some way or another, about every three years, and where this insect abounds, it will be best subdued by destroying the whole bed at the time already suggested and afterwards planting a new one; rather than by annually thinning out the old and leaving the new plants in the same bed. Here we have an effectual means of extirpating the little pest, if, as I believe, the first hypothesis is the correct one; but if the second hypothesis be correct—i. e., if the insect be double-brooded—then it will avail nothing to carry out the above suggestions, and we thus see how important it is to thoroughly understand an insect's habits in order to properly cope with it. Though we may occasionally hit upon some plan of remedying or of preventing an insect's injuries without knowing its habits, yet as a general rule we but grope in the dark until we have learned its natural history!

According to Mr. Miller, all plants infested with this larva are sure to perish, and he has also noticed that old beds are more apt to be injured by it than new ones.

In one of the roots received from him, I found a parasitic cocoon, so that there is every reason to believe that, as is so very generally the case with insects, this noxious species has at least one natural enemy which will aid us in keeping it in due bounds. Indeed, Mr. Miller so often found this parasitic cocoon, that he at first surmised that the Crown-borer spun it. But no snout-beetle larvæ spin cocoons.

This Crown-borer must not be confounded with another white worm of about the same size which lives in the ground and subsists on the roots by devouring them from the outside. This last may always be distinguished by having six distinct legs near the head, and its habits are quite different. It occurs earlier in the season, and, as I have proved the past summer, is the larva of the little clay-yellow beetle, known as the Grape-vine Colaspis (*Colaspis flavida*, Say). A full account of this last insect, with illustrations, will be given in a later portion of this Report.

The Crown-borer belongs to the genus *Analcis* which is distinguished by its sub-cylindrical oblong-oval body, its short robust snout which fits into a deep grove, its 10-jointed antennæ, and its simple or unarmed thighs. As it is a new species I subjoin a description of it for the scientific reader:—

ANALCIS FRAGARIÆ, N. Sp.—*Imago*, (Fig 14, *b*, *c*)—Color deep chestnut-brown, sub-polished, the elytra somewhat lighter. Head and rostrum dark, finely and densely punctate and with short coarse fulvous hairs, longest at tip of rostrum; antennæ rather lighter towards base, 10-jointed, the scape much thickened at apex, join 2 longest and robust, 3 moderately long, 4–7 short, 8–10 connate and forming a stout club. Thorax dark, cylindrical, slightly swollen across the middle and uniformly covered with large thimble-like punctures, and with a few short coarse fulvous hairs, unusually arranged in three more or less distinct longitudinal lines; pectoral groove ending between front legs. Abdomen with small remote punctures and hairs, which are denser towards apex. Legs of equal stoutness, and with shallow dilated punctures and uniform very short hairs. Elytra more yellowish-brown, dilated at the lower sides anteriorly, and with about 9 deeply-punctured striæ, the striæ themselves sometimes obsolete; more or less covered with coarse and short pale yellow hairs which form by their greater density, three more or less conspicuous transverse bands, the first of which is at base; between the second and third band, in the middle of the elytron, is a smooth dark-brown or black spot, with a less distinct spot of the same color below the third, and a still less distinct one above the second band. Length 0.16 inch.

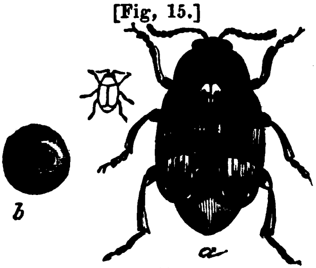
Described from four specimens bred from strawberry-boring larvæ. The black spots on the elytra are quite distinct and conspicuous on two specimens, less so on one, and entirely obsolete on the other.

Larva, (Fig. 14 *a*)—White with back arched Lamellicorn-fashion. Head gamboge-yellow, glabrous, with some faint transverse striations above mouth; mandibles rufous tipped with black; labrum emarginate, and with palpi, pale. A faint narrow dorsal vascular line. Legs replaced by fleshy tubercles. Length 0.20 inch when stretched out.

THE PEA-WEEVIL—*Bruchus pisi*, Linn.

Our common garden pea has not many insect enemies, for with the exception of the Striped Flea-beetle (*Haltica striolata*), which gnaws numerous small holes in the leaves, and the Corn-worm *alias* Boll-worm (*Heliothis armigera*), which eats into the pod, there are very few others besides the Pea-weevil under consideration. This species alone is so numerous, however, as to be a serious drawback to pea culture in this part of the country.

[Fig. 15.]



The term *Bruchus*, meaning a devourer, was given by the celebrated Linnæus to a genus of beetles which at first appear to have very little resemblance to the Snout-beetles. They form, however, at present, a sub-family (*Bruchides*) of the great Snout-beetle family, though they posses nearly as close affinities to the great *Chrysomela* family, and really form a connecting-link between the two. They are characterized by a depressed head and very short snout, by the antennæ being 11-jointed, straight and but slightly thickened towards the end, by the wing-covers being shorter than the abdomen, and by the rather long hind legs and much swollen thighs. Their larvæ are short, arched, and swollen in the middle, with a comparatively small head; and their depredations are confined all over the world, to leguminous or pod-bearing plants—another beautiful illustration of the "Unity of Habits" referred to on page 9.

They are far more abundant in the tropics than in more temperate climes, and in North America we have not many species to contend with. With the exception of the Honey-locust seed-weevil (*Spermophagus robiniæ*, Fabr.), which I have bred from the seeds of that tree, there are only two species, namely: the Pea and the Bean weevils that are really injurious in our State, though *Bruchus discoideus*, Say, often badly infests the seeds of *Ipomea*. A third species, however, namely, the Grain Bruchus of Europe, has lately been introduced into this country, and may some day become unduly multiplied in our midst.

The Pea-weevil is very generally dubbed "Pea-bug," but this latter term is not nearly so appropriate as the former, to which it should give way. Though everybody may notknow by sight the perfect beetle, yet every one has most assuredly seen the work of the worm, and though knowledge of the fact may not add to our enjoyment of a mess of green peas, yet the fact nevertheless remains, that those of us in the Mississippi Valley who indulge in this delicious esculent, necessarily devour a young worm with nearly every pea that we eat. Gray's oft quoted lines,

> —"Where ignorance is bliss,
> 'Tis folly to be wise,"

Would seem to apply here with great force; but when we reflect that the diminutive and almost imperceptible worm, nourished so to speak in the very marrow of the pea, really has no flavor and produces no injurious effects on the human system; we can chuckle in our sleeves and console ourselves with the thought that, notwithstanding the above truism, "wisdom is justified of her children." Neither this nor any other of the true weevils mentioned in this paper, can do harm when taken as food in the larva state, but there is good testimony that the hard-shell beetles are injurious when fed in a ground or unground condition, along with the seeds they infest, either to man or to other animals.

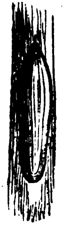
The Pea-weevil which is here well illustrated, Figure 15, *a* showing a back view, and 17, *b* a side view, the small outlines at the sides showing the natural size, is easily distinguished from all other species of the genus with which we are troubled, by its larger size, and by having on the tip of the abdomen projecting from the wing-covers, two dark oval spots which cause the remaining white portion to look something like the letter T. It is about 0.18—0.20 inch long, and its general color is rusty-black, with more or less white on the wing-covers, and a distinct white spot on the hinder part of the thorax near the scutel. There is a notch on each lateral edge of the thorax, and a spine on the under side of the hind thighs near the apex. The four basal joints of the antennæ and the front and middle shanks and feet are more or less tawny. It is supposed to be an indigenous N. A. insect, and was first noticed many years ago around Philadelphia, from whence it has spread over most of the States where the pea is cultivated. This supposition is probably the correct one though we have no means at present of proving it to be so, and certain it is that, as the cultivated pea was introduced into this country, our Pea-weevil must have originally fed on some other indigenous plant of the Pulse family. It is at present found in the more southern parts of Europe and in England, and is one of the few injurious insects which have found their way there from this country; but in accordance with the facts given in my last Report, under the head of "Imported Insects and Native American Insects," which clearly prove that our native plants and insects do not become naturalized in the Old World with anything like the facility with which those of the Old World are every day being naturalized here, this Pea-weevil does not begin to be as destructive there as it is at home.

THE FEMALE DEPOSITS HER EGGS ON THE OUTSIDE OF THE POD.

It is a very general remark that peas are "stung by the bug," and the impression prevails almost universally, not only among gardeners but with many entomologists, that the female weevil punctures and deposits her eggs *in* the pea in which the larva is to be nourished. It is a little singular that so many writers should have fallen into this error, for it is not only the accepted view amongst writers for the agricultural press, but has been adopted by many eminent entomologists, Taschenberg, Harris, and Dr. Boisduval being about the only authors who have rightly comprehended the true manner of egg-depositing. All this comes of course from one man's palming off the opinions of another as his own, and by his adopting such opinions, whether good or bad, without due credit. Even Noerdlinger in his "Kleinen Feunde der Landwirtschaft," though he cites the excellent and original observations of Taschenberg, feels himself called upon to doubt their correctness, and himself inclines to believe that the female may put her eggs in the pea. In Packard's Guide, the eggs are erroneously said to be laid on the blossoms.

The true natural history of the Pea-weevil may be thus briefly told. The beetles begin to appear as soon as our peas are in bloom, and when the young pods form, the female beetles gather upon them and deposit their eggs on any part whatever of the surface without attempting to insert the eggs within the pod.

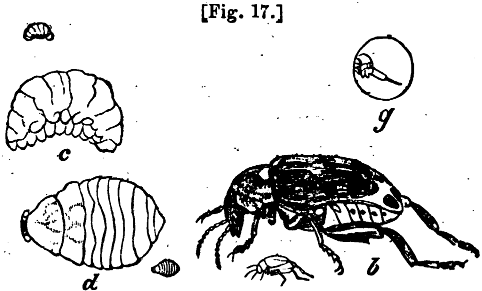
[Fig. 16.]



The eggs, (Fig. 16,) are deep yellow, 0.035 inch long, three times as long as wide, fusiform, pointed in front, blunt behind, but larger anteriorly than posteriorly. They are fastened to the pod by some viscid fluid which dries white and glistens like silk. As the operation of depositing is only occasionally noticed during cloudy weather, we may safely assume that it takes place for the most part by night. If pea vines are carefully examined in this latitude any time during the month of June, the pods will often be found to have from one to fifteen or twenty such eggs upon them, and the black head of the future larva may frequently be noticed through the delicate shell.

As already stated, the eggs are deposited on all parts of the pod, and the mother beetle displays no particular sagacity in the number which she consigns to each, for I have often counted twice as many eggs as there were young peas, and the larvæ from some of these eggs would of course have to perish, as only one can be fully developed in each pea. The newly hatched larva is of a deep yellow color with a black head, and it makes a direct cut through the pod into the nearest pea, the hole soon filling up in the pod, and leaving but a mere speck, not so large as a pin-hole, in the pea. The larva feeds and grows apace and generally avoids the germ of the future sprout, perhaps because it is distasteful, so that most of the buggy peas will germinate as readily as those that have been untouched. When full grown this larva presents the appearance of Figure 17, *c*, (after Curtis) and with wonderful precognition of its future wants, eats a circular hole on one side of the pea, and leaves only the thin hull as a covering. It then retires and lines its cell with a thin and smooth layer of paste, pushing aside and entirely excluding all excrement, and in this cell it assumes the pupa state (Fig. 17, *d*, after Curtis,) and eventually becomes a beetle, which, when ready to issue,

[Fig. 17.]



has only to eat its way through the thin piece of the hull which the larva had left covering the hole. It has been proved that the beetle would die if it had not during its larval life prepared this passage way, for Ernest Menault asserts* that the beetle dies when the hole is pasted over with a piece of paper even thinner than the hull itself.

REMEDIES AND PREVENTIVES.

Sometimes, and especially when the summer has been hot and prolonged, many of the beetles will issue from the peas in the fall of the same year that they were born, but as a more general rule they remain in the peas during the winter and do not issue till new vines are growing. Thus many yet remain in the seed peas until they are planted and especially is this apt to be the case with such as are planted early. We see, therefore, how easily this insect may be introduced into districts previously free from it by the careless planting of buggy peas, for it has been demonstrated that the beetle issues as readily from peas planted in the earth as it does from those stored away in the bin. All peas intended for seed should be examined and it can very soon be determined whether or not they are infested. The thin covering over the hole of the peas that contain weevils, and which may be called the eye-spot, is generally somewhat discolored, and by this eye-spot those peas which ought not to be planted can soon be distinguished. Where this covering is off and the pea presents the appearance of Figure 15, *b*, there is little danger, for in that case the weevil has either left, or, if still within the pea, is usually dead. It would of course be tedious to carefully examine a large lot of peas, one by one, in order to separate those that are buggy, and the most expeditious way of separating the sound from the unsound, is to throw them into water, when the sound ones will mostly sink and the unsound swim.

There are, however, other and more certain means of preventing the injuries of this insect, and whenever agriculture shall have progressed to that point where by proper and thorough organization all the farmers of a county or of a district can, by vote, mutually agree to carry out a measure with determination and in unison, then this insect can soon be exterminated; for it is easy to perceive that such a result would be accomplished by combinedly ceasing to cultivate any peas at all for one single year! Until some such united action can be brought about, we shall never become entirely exempt from this insect's depredations, for no matter how sound the peas may be that I plant, my vines are sure to be more or less visited by the beetles as long as I have slovenly neighbors. Yet comparatively, my peas will always be enough better to well pay for the trouble, even under these circumstances.

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*Insectes Nuisibles a l'Agriculture.

As already hinted the Pea-weevil prefers a warm to a cold climate, and its devastations are scarcely known in high latitudes. On this account the impression prevails that it does not occur in certain parts of Canada, and few persons are aware that it is nearly as bad, especially in Ontario, as it is with us. We are in the habit of sending to Canada for our seed peas, because we get them free from bugs; but the reason that their seedsmen have such a reputation is to be traced to their greater care in destroying the weevil and in sorting their seed rather than to any immunity from its ravages which their peas possess The following extract from a letter from Mr. Wm. Saunders, of London, Ontario, who, as secretary of the Ontario Fruit Growers' Association and as a prominent member of the Canadian Entomological Society, is as well posted, perhaps, as any one in the Dominion, will give some idea of its occurrence there:

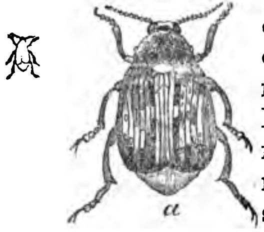
> The Pea-weevil I find prevails in all parts of Canada to a greater or lesser extent, from the Red River settlement to Quebec. In some places it is so numerous as to discourage farmers from attempting to grow peas at all, while other localities are but little troubled. About the neighborhood of Windsor (opposite Detroit) there are no peas grown worth speaking of; but 60 or 70 miles further east, towards London, they are an important crop, and about London, say within 30 or 40 miles, and as far east as Guelph and Hamilton, will include the chief district from which your western supplies are drawn.
>
> During 1869 I grew a field of peas on my own farm. They produced a good crop, and although we have some of them on hand yet I have never observed a buggy one amongst them, although I have examined them several times. But it is rare to find them so free as that and something depends on the season. Last season the weather was very wet and the crop very light, and the dealers tell me now that there are scarcely any peas fit to ship in the country on account of the quantity of bugs they contain. They say that they always have to select for shipping, and while sending them as clean as possible they do not profess to send them entirely free from bugs.
>
> Our farmers here are perhaps a little more particular than yours about their seed. They will sometimes keep it over till the second year or else scald it before planting so as to destroy a large proportion of the bugs. The general opinion seems to be that if peas are sown late, say about the first of June, they will be almost free from bugs in any season, and some adopt this method, but it is not by any means a general thing, for should the weather set in very hot, as it sometimes does about that time, they would become somewhat dwarfed and the crop lessened. I have not heard of any one growing two crops in one season.

Many eminent seedsmen—Mr. Langdon for instance as I have been credibly informed—effectually kill the weevils by enclosing the peas in tight vessels along with camphor. The same object is attained by keeping peas two years, and taking care that the beetles do not escape before they die. Peas will grow well when kept for two years or even longer, but they should always be well dried so as not to mould. A good plan is to tie them up in bags and hang them in an airy place from the time they are gathered till about Christmas, and then in order that they may not become too dry, to put them into tighter vessels. To a certain extent sound peas may be obtained by planting late, for the period of egg-depositing is limited to about a month. Peas, as Mr. F. A. Nitchy of Jefferson City has demonstrated, may be planted in the central part of the State as late as the first of June, and by the time the plants from such late planted seed begin to bear pods, all the weevils will have died and disappeared. Wherever a second crop of peas can be grown the same year, this second crop will be entirely free from weevils, and though there seems to be some difficulty in producing a second crop in our State, on account of mildew, it is often done in higher latitudes. Choice lots of seed, if found to be infested when received from the seedsman, may be thrown into hot water for a minute or two, and the sprouting of the peas will be quickened, and most of the weevils, but not all, be killed. But whatever plan be adopted to obtain sound seed, it should be every man's aim, in duty to himself and to his neighbors, to plant none but bugless peas!

As natural checks, the Crow Black-bird is said to devour great numbers of the beetles in the spring, and according to Harris the Baltimore Oriole splits open the pods to get at the grubs contained in them.

THE GRAIN BRUCHUS—*Bruchus granarius*, Linn.

[Fig. 18.]



There is a weevil in Europe which is very common, attacking peas there as badly as our own Pea-weevil does in this country. It also infests beans and several other grains and seeds. It has on several occasions been imported with foreign seeds into this country, but very fortunately does not seem so far to have obtained a strong foothold. There is nothing to prevent its doing so, however, except the utmost vigilance on the part of those who import seeds, and it may at any time get scattered over the country by the distribution of infested seed from the Department of Agriculture, unless the authorities are ever watchful to prevent such a catastrophe. To enable a ready recognition of this weevil, I present an enlarged portrait of it at Figure 18. As will be noticed by that figure it bears a tolerably close resemblance to our own Pea-weevil, but it may always be distinguished from the latter species by the following characters as given by Curtis:—

It is in the first place a smaller insect, averaging but 0.14 inch while *pisi* averages nearly 0.20 inch. It is rather darker, there are two small white spots on the disk of the thorax, and the tooth at each side of the thorax is indistinct; the suture of the wing-covers forms a brown stripe, and the apical joint of the abdomen which protrudes beyond the wing-covers and which is otherwise known as the pygidium, is densely clothed with grayish pubescence, and shows in certain lights four minute dark dots, but no indication of the two large oval spots so characteristic of our Pea-weevil. The four basal joints of the antennæ and the front legs are reddish, and the inner spine of the hind shanks is prolonged.

It would be a sad misfortune to have this insect added to our list of injurious species, and it is no wonder that upon discovering specimens of our own Pea-weevil just disclosed in a parcel of peas which he had taken with him from America, the Swedish traveler Kalm was thrown into such a trepidation lest he should be the instrument of introducing so fatal an evil into his beloved country.

To give some idea of the habits of the Grain Bruchus, I quote the following account from Curtis's Farm Insects:—

"This species, which is everywhere abundant as early as February on the furze when it is in blossom, inhabiting also the flowers of various other plants in the beetle state, as the Rhubarb, Meadow-sweet (*Spiræa ulmaria*), etc., is a most destructive insect in our pea and bean fields, the larvæ feeding in the seeds and sometimes destroying more than half the crop. They are exceedingly abundant in some parts of Kent, where they often swarm at the end of May, and are occasionally found as late as August; indeed I killed one in November, imported with Russian beans, which had been alive since the end of September. It attempted to fly away in October; it then became torpid, but on warming it by a fire in the middle of November, it was as lively and active as in the height of summer, and I dare say would have lived through the winter.

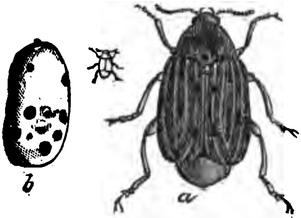
"It is said that the female beetles select the finest peas to deposit their eggs in, and sometimes they infest crops to such an extent that they are eaten up by them, little more than the husk being left. The various kinds of beans are equally subject to their inroads; besides the long-pods I have alluded to, I have had broad Windsor beans sent to me containing these *Bruchi;* and Mr. C. Parsons transmitted me some horse-beans in the beginning of August, 1842, which were entirely destroyed by them. Mr. F. J. Graham showed me some seed beans which were inoculated by these beetles to a great extent, and some of them were alive in the seeds; yet to any one ignorant of the economy of this pest, there would not appear the slightest external indication of their operations. I also received from a gentleman residing in Norfolk a sample of seed beans from Russia, for winter sowing, a large proportion of which was perforated by this *Bruchus.*

"It has already been intimated that as the beetles generally leave the germ uninjured, the vitality of infested seeds is not destroyed. I doubt, however, if they produce strong healthy plants; and from my own experience I have no doubt if peas and beans be sown containing the *Bruchus granarius*, that the beetles will hatch in the ground, and thus the cultivator will entail upon himself a succession of diseased pea and bean crops. Now to avoid this loss, the seed should be examined before sowing, when to an experienced eye the presence of these beetles will be discernible, where to a common observer they would appear sound and good. The maggots, when arrived at their full size, gnaw a circular hole to the husk or skin of the seed, whether pea or bean, and even cut around the inner surface which covers the aperture, so that a slight pressure from within will force this lid off;

these spots are of a different color to the rest of the seed, generally having a less opaque appearance, and often are of a duller tint; on picking off this little lid, a cavity will be found beneath containing either a maggot, pupa, or beetle."

THE AMERICAN BEAN-WEEVIL—*Bruchus fabæ,* N. sp.

[Fig. 19.]



This is another *Bruchus* which bids fair to out-do the celebrated Pea-weevil in its injurious work, and since it has but just made its appearance in our State as a bean destroyer, and is yet confined, so far as I am aware, to one single locality, I hope that the following account of it will have the effect to prevent its introduction into neighborhoods where it is now unknown, and thus keep it from spreading over the State. It appears to be a native American insect and doubtless fed originally on some kind of wild bean (*Phaseolus* or *Lathyrus*,) but it was first noticed in our cultivated beans about ten years ago, in Rhode Island, and has since at different times suddenly made its appearance in several other parts of the country. Maj. J. R. Muhleman, of Woodburn, Ills., informs me that while in South Carolina in 1863, some kind of weevil was often so common in the beans used by the army that before using such beans the men had to soak them, and afterwards lay them out to dry, in order to allow the beetles to escape. The weevil was doubtless the species under consideration, but there is no means of ascertaining from which part of the country the beans came.

Though already pretty well distributed in some of the Eastern States, especially in New York, it appears to be yet confined to certain localities in the Mississippi Valley. It has for instance, been quite troublesome of late years in Madison county, Ills., for I received last spring numerous specimens from Mr. Geo. W. Copley, of Alton, and am informed by Mr. J. F. Wielandy, of Jefferson City, Mo., that his father who is a resident of that county has been much troubled with it; yet it has never been heard of in other parts of the State. The only place in which I have, so far, found it in Missouri, is around Eureka, in St. Louis county, where it was first noticed in 1869, but where it occurred the present year in great numbers in two different fields of a white pole bean. It occurs in some parts of Pennsylvania, and is quite common in New York, and to illustrate the amount of damage it is capable of doing, I make room for the following letter, which was received in November, 1870, from Mr. James Angus, of West Farms, N. Y., and which refers to this insect:

> I enclose you a sample of beans to show you how thoroughly and effectually this little vagabond is plying his time immemorial avocations in the bean-patches in this quarter. Five or six years ago I had occasion to call on a neighbor, and in passing through the barn he

pointed out to me a heap of threshed beans, on the floor, of the Early Mohawk variety, which he said had been destroyed by bugs getting into them since they were threshed. (?) A casual inspection showed that they were destroyed sure enough. At least one-half of them were as badly infested as the sample I send you, but as I pointed out to him, the damage which was now an accomplished fact, had been commenced during the growing season, and the "bugs" were now leaving the beans instead of entering them.

Next season I found a few among my own beans, and they have been on the increase ever since; and this year my Yellow Six Week variety are nearly as bad as my neighbors referred to above. They are nearly as bad this year on a pole variety, the "Dutch Case Knife," as they are on the low growing ones. The small black bush variety, however seems to have escaped them. If some check is not put to their ravages soon, the culture of beans will have to be given up here.

In a short article on this weevil, published by Mr. S. S. Rathvon, in the *American Entomologist*, (Vol. II, pages 118-119,) that gentleman gives the following account of its appearance in his neighborhood:

My specimens evolved in the months of June, July, August and September, from three varieties of the domestic bean (*Phaseolus*,) commonly called "Cranberry," the "Agricultural," and the "Wrens-egg" beans, obtained from Mrs. P. C. Gibbons, Enterprise, Lancaster county, Pa. * * * * I have not yet heard of this insect being found in any other locality in Lancaster county than the one above named. The tenant from whom Mrs. Gibbons received these infested beans has been engaged in the bean culture for twenty-five years on the same farm, and never noticed these weevils until within the last two or three years, and only last year did their destructive character become conspicuously apparent; for out of a small sack of seed-beans hung away, containing less than two quarts, she gathered nearly a teacup-full of the weevils at planting time, in the early part of June, and had all been infested as those were which she brought to me, she could have easily doubled the quantity. About five years ago Mrs. Gibbons received some seed-beans of the "Cranberry" variety, from Nantucket, Mass., and prior to that, she also received some from the Agricultural Department of the Patent Office, and with the one or the other of these, the impression is that the weevils must have been received.

If, as I have supposed (and by perusing what is printed below in small type, the reader will see that no other conclusion can be drawn), this weevil is indigenous; it may possibly occur over large tracts of our country, though the fact that, till a few years ago, it had never been collected by any American entomologist, would strongly intimate that, in what may be termed its wild state, it was quite rare and had a limited range. But even if it should occur in this wild state more generally through the country than the facts would lead us to believe, there is nevertheless more danger of its being introduced into a bean field hitherto exempt by the planting of infested cultivated beans, than by its spreading from the wild food. And if once a few buggy beans are planted, they will in a few years contaminate the other beans cultivated in the neighborhood, so that the man who year after year grows his own seed will suffer as much as the man who originally introduces the weevils from afar.

Except in being smaller, the larva and pupa of this weevil have a close resemblance to those of the Pea-weevil, and its habits are very similar, with the exception that the female deposits a greater number of eggs on a single pod, so that sometimes over a dozen larvæ enter a single bean. I have counted as many as fourteen in one small bean, and the space required for each individual to develop is not much more than sufficient to snugly contain the beetle. The little spot where the Pea-weevil entered can always be detected even in the dry pea, but in the bean these points of entrance become almost entirely obliterated. The cell in which the transformations take place is more perfect and smooth, and the lining is easily distinguished from the meat of the bean by its being more white and opaque. The excrement is yellow or darker than the meat, and even where a bean is so badly infested that the inside is entirely reduced to this excrementitious powder, each larva, before transforming, manages to form for itself a complete cell, which separates it from the rest of its brethren. The eye-spot, as in the pea, is perfectly circular and quite transparent in white-skinned varieties, so that infested beans of this kind are easily distinguished by the bluish-black spots which they exhibit (Fig. 19, *b*). Dark beans when infested are not so easily distinguished.

I have always found the germ either untouched or but partially devoured even in the worst infested beans, so that when but two or three weevils inhabit a bean, it would doubtless grow; but where the meat is entirely destroyed, as it often is, the bean would hardly grow though the germ remained intact, and it would certainly not produce a vigorous plant.

Many of the beetles are perfected in the fall, but many of them not till the following spring, so that there is the same danger of introducing them in seed-beans, as in the case of the Pea-weevil. The remedies and preventives given in the former case will of course apply equally well in this, and I hope that every bean-grower in Missouri who reads this article will make some effort to keep the scourge out of his own neighborhood, by urging upon others, at the Farmers' Club, or at the meetings of any local societies, the necessity of sowing only sound seed, and of thoroughly destroying any that may be received from abroad and found buggy.

Regarding the proper nomenclature of our Bean-weevil, there has been some confusion, and though it has heretofore been considered by several eminent entomologists as the *Bruchus obsoletus* of Say, and I have heretofore, upon insufficient grounds, referred it to that species myself, it nevertheless turns out to be undescribed. In Europe, besides the Grain Bruchus which I just treated of, there are several other species belonging to the same genus which attack beans; but our insect differs from all of them and especially from the Grain Bruchus, to which it has been erroneously referred by Dr. A. S. Packard, Jr.* If it were the imported Grain Bruchus, our peas and some other grains would probably suffer as much from its attacks as our beans, because that species infests peas and other seeds in Europe; but in reality we have no more reason to believe that our Bean-weevil will attack our peas than that the Pea-weevil will attack our beans.

The general color of our Bean-weevil is tawny-gray, the ground-color being dark and the whole body covered with a grayish pubescence which inclines to yellow or fulvous, or wears a slight moss-green hue, and is shaded as in Figure 19, *a*. It is but half the size of the Pea-weevil and has the four or five basal joints and the terminal joint of the antennæ, and the legs, with the exception of the lower and inner part of the hind thighs, reddish-brown.

BRUCHUS FABÆ N. Sp. (Fig. 19,)—General color tawny-gray with more or less dull yellowish. *Body* black tinged with brown and with dull yellowish pubescence, the pygidium and sides of abdomen almost always brownish. *Head* dull yellowish-gray with the jaws dark brown and palpi black; antennæ not deeply serrate in ♀, more so in ♂; dark brown or black with usually 5, sometimes only 4, sometimes 4 and part of 5 basal joints, and with the terminal joint, more or less distinctly rufous, or testaceous, the color being so slight in some specimens as scarcely to contrast at all with the darker joints. *Thorax* narrowed before, immaculate, but with the pubescence almost always exhibiting a single pale medio-dorsal line, sometimes three dorsal lines, more rarely a transverse line in addition, and still more rarely (two specimens) forming a large dark, almost black patch each side, leaving a median stripe and the extreme borders pale and thus approaching closely to *erythrocerus* Dej.; base with the edges almost angulated; central lobe almost truncate and with a short longitudinal deeply impressed median line; no lateral notch; scutel concolorous and quadrate with the hind edge more or less notched. *Elytra* with the interstitial lines having a slight appearance of alternating transversely with dull yellowish and dusky; so slight however that in most of the specimens it can hardly be traced: the dark shadings form a spot on each shoulder and three transverse bands tolerably distinct in some, almost obsolete in others, the intermediate row being the most persistent and conspicuous: between these dark transverse rows the interstices are alternately more or less pale, especially on the middle of the 3rd interstitial lines. *Legs* covered with grayish pubescence, and with the tibiæ and tarsi, especially of first and second pair, reddish-brown; the hind thighs usually somewhat darker, becoming black below and inside, and with a tolerably long black spine followed by two very minute ones. Length 0.09—0.14 inch. Described from 40 specimens all bred from different kinds of beans. Hundreds of others examined.

This insect has been for several years ticketed in some of the Eastern collections by the name of *B. fabæ*, or else, what is worse, the corruption of it, *fabi*. The former name has been disseminated by my friend F. G. Sanborn of Boston, Massachusetts, who says that he received the weevil thus named, together with beans attacked by it, in the year 1862 from Rhode Island. The name was credited to Fabricius, but I can find no notice in any of the works I possess of any European *Bruchus fabæ*, and several of my Eastern correspondents who have access to large libraries have been unable to find any description or allusion to a species by that name. Dr LeConte has given it the MS name of *varicornis* but as his description will not appear perhaps for years to come and as no comprehensive description has yet been published, I have deemed it advisable to dispel in a measure the confusion that surrounds the nomenclature of the species. There is need of a description of so injurious an insect, and as *fabæ* is not preoccupied I adopt the name because it is entirely appropriate and because it is more easily rendered into terse popular language that *varicornis*. †

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* Injurious insects new and little known, pp. 19–21.

† No one can have a greater regard than I have, for the work of our great Coleopterist, Dr. LeConte, who is justly looked up to as our authority in his specialty; and for no other reason than the one given above would I venture to disregard even one of his manuscript names. Were he now at home, I should have corresponded with him on the subject, and I feel satisfied that he would have sanctioned this course. These remarks are prompted by the fact that certain entomolo-

It resembles most closely of any other species which I have seen, the *B. erythrocerus*, Dej. which, however, is smaller, and differs in having a narrower thorax which has light sides and a dark, broad dorsal stripe divided down the middle by a pale narrow line: *erythrocerus* is further distinguished by the antennæ being entirely testaceous and the hind thighs more swollen.

From *obsoletus* Say, *fabæ* differs materially: *obsoletus* is a smaller species, dark gray, with the antennæ all dark, the pygidium not rufous, the thorax with a perceptibly darker dorsal shade so that the sides appear more cinereous, a white scutel, and each interstitial line of the elytra with a slight appearance of alternating whitish and dusky along its whole length; for though there is nothing in Say's language to indicate whether it is the interstitial lines that alternate transversely, whitish and dusky, or each line that so alternates longitudinally, I find from an examination of a specimen in the Walsh collection, that the latter is the case, and so much so that the insect almost appears speckled. The two species differ both in size and color, though, as Say's description is short and imperfect it is not surprising that *fabæ* should have been referred to it.

From the European bean-feeding *Br. flavimanus* (which is apparently either a clerical error for, or a synonym of *Br. rufimanus*, Schœnh.) as described by Curtis, it differs notably; as it does likewise from their *Br. serratus*, Ill., which also attacks beans.

Dr. LeConte, according to Mr. Rathvon, was inclined to consider this insect the *obsoletus* of Say, from the fact that in specimens which the latter gentleman sent him, the antennæ were not varied as in his MS. *varicornis*, but uniformly black. A few specimens which Mr. Rathvon sent me nearly two years ago, taken from the same lot as were those which he forwarded to Dr. LeConte, were singularly enough, all decapitated but two; and these two showed the varied antennæ. These specimens had all been kept in alcohol, and I am greatly inclined to believe that the uniformly dark appearance of the antennæ that was noticed by LeConte was the effect of the alcohol on those which naturally had the rufous joints but faintly indicated. At all events, though Mr. Rathvon tells me that he found a small proportion of beetles with dark antennæ, after examining, at my suggestion, over two hundred specimens that had thus been kept in alcohol; yet from over one hundred specimens which he had the kindness to send me, I only find (after thoroughly drying them) three with the terminal joint really as dark as the subterminal, and not a single one in which the rufous basal joints cannot be more or less distinctly traced.

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gists have objected to isolated descriptions of insects, on the plea that they cause confusion and an unnecessary synonymy in our nomenclature. There is, in fact, a certain class of persons—and they have been aptly termed closet-entomologists—who manifest a superlative contempt for anything that does not appear in the transactions or publications of some scientific society; and they even claim that the descriptions which have appeared in State Entomological Reports are invalid and should be disregarded. The descriptions of Dr. Fitch, and many of those of the late Mr. Walsh, and my own, would of course come under this head. It is a little significant, however, that the very persons who manifest such a contempt for scientific work, whenever it is combined with the practically useful, are the very ones who indulge in the fatal monomania for grinding out new species from the mere comparison of a few more or less damaged specimens of the perfect insects, obtained nobody knows how, when or where; and without even the slightest knowledge of the larval and pupal history and the general habits of the so-called species. They make species out of the slightest individual variation, and even erect genera upon a slight individual difference in the size or shape of the wing. So baseless a system must necessarily be fraught with great scientific untruthfulness, and is well calculated to disgust the student who endeavors to rightly interpret the significances in Nature. An immense number of the published descriptions in the Class of insects in this country are based upon the simple examination of solitary specimens of the perfect insects, without the fact being mentioned, and are therefore not in any true sense of the term descriptions of species, but mere descriptions of individuals. The few men whose sole ambition seems to be to attach their names to as many of these so-called species as possible, are the ones who are most inclined to sneer at, and treat lightly the honest work of more practical men—forgetting that science does not consist of mere classification and orderly arrangement, but that she wears a nobler mien when applied to penetrating and comprehensive search after Nature's truths.

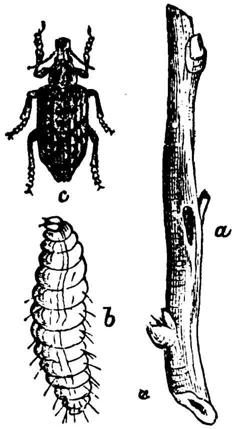
A truth is equally scientific, whether published in a plain, practical work, or in the drier pages of the transactions of some august scientific body; and so far as the science of entomology is concerned, it will certainly be more advanced by the full and comprehensive description of a species, albeit such description be clothed in plain terms and published in a popular work, than by a less complete and more confused description, in the transactions of an Entomological Society; and provided it is published in a work essentially entomological, the monographer will certainly prefer the former to the latter. In the past, science belonged to the few, and was always paraded before the world in as unattractive and technical a form as possible. To-day she is fast becoming the property of the multitude, and should be popularized as much as possible; for it is folly to suppose, as some men do, that in science "popular" and "inaccurate" are synonymous terms, simply because some writers have failed to combine the scientifically accurate with the popular and practical.

The entomologist who occupies himself with the habits of insects, cannot well become a systematist, and would far sooner accurately describe the hitherto unknown habits and transformations of a single common species, than describe a dozen new ones. He may have hundreds of new species in his cabinet; but these he prefers to turn over to the specialist, whose work he fully appreciates and whose aid he must often seek. When, however, in the course of his work, he is obliged to publish an isolated description, the specialist proper should certainly not depreciate his labor, providing it is well performed.

THE NEW YORK WEEVIL—*Ithycerus noveboracensis*, Forster.

The large gray beetle represented at *c*, in the accompanying cut often does considerable damage to fruit trees, and I continually receive it every spring by persons who desire to know more of its habits. It kills the twig by gnawing off the tender bark, in the early part of the season before the buds have put out, and later in the year it destroys the tender shoots which start out from old wood, by entirely devouring them. It eats out the buds and will also frequently gnaw off the leaves at the base of the stem, after they have expanded. It attacks, by preference, the tender growth of the Apple, though it will also make free with that of Peach, Plum, Pear and Cherry, and probably of other fruit as well as forest trees. It is the largest snout-beetle which occurs in our State. and with the rest of the species belonging to the same genus (*Ithycerus*=straight-horn) it is distinguished from most of the other snout-beetles by the antennæ or feelers being straight instead of elbowed or flail-shaped as they are in the common Plum Curculio, for instance. The specific name *noveboracensis* which means "of New York" was given to this beetle just 100 years ago by Forster, doubtless because he received his specimens from New York. But like many other insects which have been honored with the name of some Eastern State, it is far more common in the Mississippi Valley than it is in the the State of New York, it scarcely being known as an injurious insect in the East. It was subsequently described as *Pahyrhynchus Schœnherri* by Mr. Kirby. The general color of the beetle is ash-gray, marked with black as in the cut (Fig. 20, *c*), and with the scutel or small semi-circular space immediately behind the thorax, between the wings, of a yellowish color. Its larval habits were for a long time unknown, but two years ago I ascertained that it breeds in the twigs and tender branches of the Bur oak, and have good reason to believe that it also breeds in those of the Pignut hickory. The female in depositing, first makes a longitudinal excavation with her jaws (Fig. 20, *a*) eating upwards under the bark towards the end of the branch, and afterwards turns round to thrust her egg in the excavation. The larva, (Fig. 20, *b*) hatching from the egg is of the usual pale yellow color with a tawny head. I have watched the whole operation of depositing, and, returning to the punctured twig a few days after the operation was performed, have cut out the young larva; but I do not know how long a time the larva needs to come to its growth, nor whether it undergoes its transformations within the branch, or leaves it for this purpose to enter the ground; though the former hypothesis is the more likely.

[Fig. 20.]



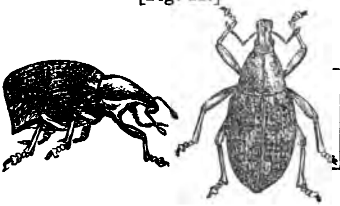
This insect is more active at night than during the day, and is often jarred down upon the sheet or the Curculio-catcher, for it falls about as readily as the Plum Curculio.

The destructive pear blight, otherwise known as fire-blight, has been attributed to a peculiar poisonous fluid which this beetle secretes and with which it poisons the wood.* I have never noticed any such secretion, and feel quite convinced that it has nothing to do with the real pear blight (and there are more than one kind) which is very justly considered by the most eminent horticulturists of the land to be of fungoid rather than insect origin. It is quite probable that the beetle secretes some such fluid which causes a sort of blight, because several bark-boring and wood-boring beetles are known to produce such an effect; but this insect-blight must not be confounded with the far more subtle and destructive Pear Blight, so called.

THE IMBRICATED SNOUT-BEETLE—*Epicœrus imbricatus*, Say.

This is another insect, which is quite frequently met with on our different fruit trees, doing considerable injury to apple and cherry trees and gooseberry bushes, by gnawing the twigs and fruit. Its natural history is, however, a sealed book, and I introduce it at present more to draw the attention of orchardists to this fact than to give any information with regard to it. The beetle is a native of the more Western States and is found much more commonly in the western part of the State, in Iowa, Kansas, and towards the mountains than it is on the eastern side of the great Father of Waters.

[Fig. 21.]



The general color is a dull silvery-white with brown markings as in the figure (Fig. 21), which are sometimes dark and distinct, and at others almost obsolete. Indeed the species is so variable that it has received no less than four distinct names, *i. e.* four distinct species have been fabricated out of one.†

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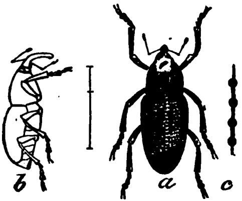
*See a communication from H. H. Babcock, of Chicago, in the *Am. Entomologist and Botanist*, Vol. II, p. 176.

†There can be no doubt of this, for the range of variation is so great that specimens agreeing in every respect with *imbricatus, fornudolosus, vadosus* and *fallax*, are to be met with in very limited localities; and both Dr. LeConte and Mr. Walsh were of opinion that these four so-called species were but varieties.

THE CORN SPHENOPHORUS—*Sphenophorus zeæ*, Walsh.

[Fig. 22.]



In the last number of the *Practical Entomologist*, Mr. Walsh gave the first account of a weevil which in certain years does great damage to the corn crop by puncturing the young plant near the ground, and riddling it with holes of about the size that an ordinary pin would make. They may even be found under ground attached firmly to the stalk, and when numerous enough the plant always dies.

The color of the beetle is brown-black or black, often obscured by yellowish or grayish matter adhering to, and filling up the hollow punctures. Figure 22 gives a good illustration of it, *a* showing a shaded back view, *b* an outline side view, and *c* showing the manner in which the wing-covers are punctured. The original description as given by Mr. Walsh will be found below.

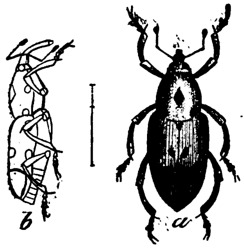
In the spring of 1868, Mr. L. V. Smith, of Geneva, Ontario county, N. Y., sent me numerous specimens; and I have often found it in great numbers on the lake-beach at Chicago, though it does not seem to be common in our own State. But it is well that corn-growers be made familiar with its appearance.

The larval history of this weevil is unknown, but there seems good reason to believe that it breeds in rotting and moist wood, situated in places where it is constantly washed by the water; for the beetles, with others belonging to the same genus are found in such situations and in decayed logs floating in swamps. If this supposition be the correct one—and the fact that it has been injurious only in the immediate neighborhood of rivers and lakes adds great weight to such a supposition—then this weevil will not be likely to multiply unduly where there are not large bodies of water.

"SPENOPHORUS ZEÆ, new species? Color black, often obscured by yellowish matter adhering to the hollow places, which, however, can be partially washed off. Head finely punctured towards the base, with a large dilated puncture between the eyes above. Snout one-third as long as the body, of uniform diameter, as fine as a stout horse-hair, and curved downwards. Before the middle of the thorax a polished diamond-shaped space, prolonged in a short line in front and in a long line behind; and on each side of this an irregularly defined polished space, somewhat in the form of an inverted Y; the rest of thorax occupied by very large punctures, which fade into finer and sparser ones on the polished spaces. Wing-cases with rows of still larger punctures, placed very wide apart in the usual grooves or striæ; the sutural interstice, that between the 2nd and 3rd striæ, and that between the 4th and 5th striæ wider than the rest, elevated, and occupied by very fine punctures; a small elongate-oval polished spot on the shoulder and another near the tip of the wing-case. Beneath, polished, and with punctures as large as those of the thorax.—Length about three-tenths of an inch, exclusive of the snout. Comes very near *Sphenophorus truncatus* Say, but the snout is not "attenuated at tip" and has no "elongated groove at base above;" and moreover, nothing is said in the description of that species of the very large and conspicuous punctures, found in the elytral striæ of our species."

THE COCKLEBUR SPHENOPHORUS—*Sphenophorus pulchellus*, Schœnherr.

[Fig. 23.]



In closing this chapter on snout-beetles I introduce this species (Fig. 23, *a* shaded back view; *b* outline side-view,) not that it is injurious, but because it belongs to the same genus, and is closely allied to the preceding insect; and because its larval habits, which are now given for the first time, may lead us more readily to discover those of its more injurious ally.

The color of this beetle above, is of a deep brick-red inclining to blood-red, often with a tinge of orange, and it is marked with black as in the figure; the whole underside being also black. The larva bores the stalks of the common cocklebur (*Xanthium strumarium*,) and differs from most other snout-beetle larva in having a dark mahogony-brown head, and in the anal joint being slantingly truncated and furnished with fuscous elevations which give rise to short stiff bristles. It transforms in the fall of the year within the stem and issues as a beetle about the end of September.*

Of our other N. A. snout-beetles may be mentioned as especially injurious the Grape Curculio (*Cœliodes inæqualis*, Say), Grape-cane Curculio (*Baridius sesostris*, Lec.) Potato-stalk weevil (*Baridius trinotatus*, Say), the different nut-weevils (genus *Balaninus*), the Grain-weevil (*Sitophilus granarius*, Linn.), the White-pine weevil (*Pissodes strobi*, Peck), and the Cranberry-weevil (*Anthonomus suturalis*, Lec.) The first three have already been treated of in my first Report, the nut-weevils will form the subject of a future article, and the others have either been fully treated of in standard works or are not particularly injurious in Missouri.

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*This insect seems to differ from 13-*punctatus*, Say, in absolutely nothing but in having a large black patch at the tip of the elytra instead of two spots. I have bred four specimens from cocklebur, and they are all tolerably constant in the characters accorded to *pulchellus*. But I am strongly of opinion that we have to deal here with but one species, and that with a sufficiently large series, the dividing line could not be drawn. At all events 13-*punctatus* is very variable in the size of its spots, and the greatest variation occurs in these two at the tip of the elytra, while Say describes and figures a variety of his 13-*punctatus* which is singularly intermediate between the two species. In three specimens of 13-*punctatus* in my cabinet, the two posterior spots are so large that they almost meet, while in some specimens they are not larger than the other elytral spots.

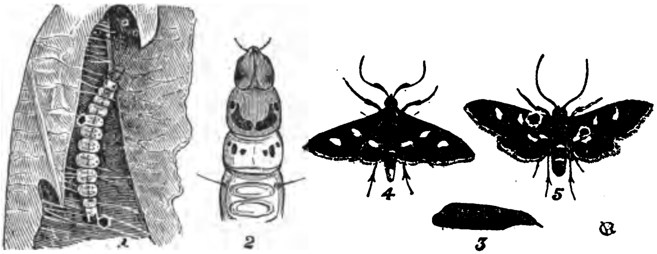
INSECTS INJURIOUS TO THE GRAPE-VINE.

The following articles under this head are a continuation of the series began in my first and continued in my second Report, and I shall continue the series until all the insects of any note, which affect the Grape-vine, shall be treated of.

THE GRAPE LEAF-FOLDER—*Desmia maculalis*, Westw.

(Lepidoptera, Asopidæ.)

[Fig. 24.]



The subject of this sketch has long been known to depredate on the leaves of the Grape-vine in many widely separated parts of North America. It is not uncommon in Canada West, and is found in the extreme southern parts of Georgia. It appears to be far more injurious, however, in the intermediate country, or between latitude 35° and 40°, than in any other sections, and in Southern Illinois and Central Missouri proves more or less injurious every year. It was first described and named by Westwood,* who erected, for it, the genus *Desmia*.

The genus is characterized by the elbowed or knotted appearance of the ♂ antennæ, in contrast with the smooth, thread-like ♀ antennæ; the maxillary palpi are not visible, while the compressed and feathery labial palpi are recurved against the eyes, and reach almost to their summit; the body extends beyond the hind wings.

The moth of the Grape Leaf-folder is a very pretty little thing, expanding on an average almost an inch, with a length of body of about one-third of an inch. It is conspicuously marked, and the sexes differ sufficiently to have given rise to two names, the female having been named *Botys bicolor*. The color is black with an opalescent reflection, and the under surface differs only from the upper in being less bright; all the wings are bordered with white. The front wings of both sexes are each furnished with two white spots;† but while in the male (Fig. 24, 4) there is but one large spot on the hind wings, in the female (Fig. 24, 5) this spot is invariably more or less constricted in the middle, especially above, and is often entirely divided into two distinct spots. The body of the male has but one distinct transverse band, and a longitudinal white dash at its extremity superiorly, while that of the female has two white bands. The antennæ, as already stated, are still more characteristic, those of the male being elbowed and thickened near the middle, while those of the female are simple and thread-like.

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* Mag. Zool., par M. Guérin, 1831; pl. 2.

† Mr. Glover, in the Agricultural Report for 1854, p. 79, says that the male has a semi-lunar mark of white on the outside of each spot, which in his figure, pl. 6, ibid., is very distinct. In dozens of specimens bred in Illinois and Missouri no such mark appears, though there is an apparent coincident shade, barely distinguished from the black ground-color, on the outside of each spot in both male and female.

There are two broods in this latitude—and probably three farther south—during the year; the first moths appearing in June, the second in August, and the worms produced from these last hibernating in the chrysalis state. The eggs are scattered in small patches over the vines, and the worms are found of all sizes at the same time. These last change to chrysalids in 24 to 30 days from hatching, and give forth the moths in about a week afterwards.

The worm (Fig. 24, 1) folds rather than rolls the leaf, by fastening two portions together by its silken threads; and for this reason, in contradistinction to the many leaf-rollers, may be popularly known as the "Grape Leaf-folder." It is of a glass-green color,* and very active, wriggling, jumping and jerking either way at every touch. The head and thoracic segments are marked as at Figure 24, 2. If let alone, these worms will soon defoliate a vine, and the best method of destroying them is by crushing suddenly within the leaf, with both hands. To prevent their appearance, however, requires far less trouble. The chrysalis is formed within the fold of the leaf, and by going over the vineyard in October, or any time before the leaves fall, and carefully plucking and destroying all those that are folded and crumpled, the supply for the following year will be cut off. This should be done collectively to be positively effectual, for the utmost vigilance will avail but little if one is surrounded with slovenly neighbors.

I believe this insect shows no preference for any particular kind of grape-vine, having found it on well nigh all the cultivated as well as the wild varieties. Its natural enemies consist of spiders, wasps, and a small undescribed species of *Tachina*-fly which I have ascertained to infest it in the larva state, and to which I have given the MS. name of *desmiæ*. There is every reason to believe that it is also attacked by a small clay-yellow beetle, the Grape-vine Colaspis

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* I subjoin a description of this worm, as first given by me in the Prairie Farmer Annual for 1868. Average length, 0.80. Largest on abdominal joints, and tapering thence slightly each way. Color glass-green, always darker above than below. A narrow darker dorsal line, with each joint swollen into two transverse wrinkles. Laterally paler or yellowish, and a large and distinct piliferous spot on each joint, with others scarcely visible with a lens. Head fulvous, polished, horizontal, with two small eyespots and two larger dark patches. Joint 1 of the same color, and marked as in Figure 24, 2. Joint 2 has two small spots, with an intermediate larger one, on each side. Legs yellowish. Acquires a carneous or pink tint before changing to chrysalis, which latter is of the normal color, size and form of Figure 24, 3, and has at the tail several very minute curved hooks, joining and forming into a point.

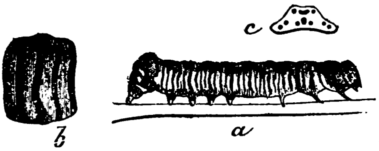
(*Colaspis flavida*, Say,) which is described further on, and which, though a vegetable feeder, may often be found in the fold of the leaf in company with some shrunken, half-dead worm.

THE GRAPE-VINE EPIMENIS.—*Psychomorpha epimenis*, Drury.

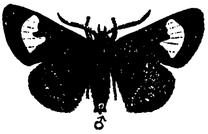
(Lepidoptera Zygænidæ.)

Under the head of "Blue Caterpillars of the Vine," an account was given in my last Report (pp. 83–5) of the Pearl Wood Nymph, (*Eudryas unio*, Huebner), and of what I thought there was good reason to believe was its larva, namely, the smaller of the blue caterpillars (Fig. 25, *a* full grown caterpillar; *b* enlarged side view of one of the joints; *c* enlarged hump on the 11th joint). I have since been able to decide definitely as to the character of this larva, having bred numerous specimens to the perfect state. It turns out to be an entirely different insect to what I had conjectured, and produces a beautiful little moth (Fig. 26), which may be known to the grape-grower as the Grape-vine Epimenis.

[Fig. 25.]



[Fig. 26.]



This moth is most strikingly marked and bears no resemblance whatever to the Pearl Wood Nymph. Its color is deep velvety-black with a broad irregularly lunate white patch across the outer third of the front wings, and a somewhat larger, more regular patch of orange-red or brick-red on the hind wings. The underside is similarly marked, but that of the front wings is less velvety with two additional white spots inside near the costa, the outer one generally, and sometimes both of them, connected with the broad white patch. Especially is this the case in the males; the wing appearing to have a large triangular white patch with two quadrate black spots in it connected with the costa. The wings are beautifully tinselled with steel-blue, or purplish scales, which form a narrow band near the outer margin of each and appear more or less distinctly on the basal half of the front wings. On the under side the steel-blue is especially conspicuous on the costa and hind border of the hind wings. In old specimens the scales get much rubbed off and the general color appears duller and more brown. The antennæ of the female are thread-like and with alternate black and white scales. Those of the male are beautifully and broadly toothed on two sides, or bi-pectinate, and he is furthermore distinguished from the female by the more uniform diameter of his abdomen which is slightly tufted and squarely cut off at the apex.

A full account was given of the larva in the article already referred to, and the proper remedy for its injuries suggested, so that I shall simply add below a technical description of it. Its habit of boring into some substances to prepare for the change to pupa, is inveterate, and it always neatly covers up the orifice so that it is difficult to detect. I have had over a dozen of them enter a single cork but 1¼ inches in diameter and about an inch deep; and such a cork, if given during May of one year to an uninitiated person, with instructions to keep it in a glass vessel, will cause much surprise and interest the following March when the moths will begin to issue from it.

Dr. Melsheimer* wrote to Dr. Harris on the 28th of February, 1840, that he had bred this moth from the larva, and rightly states that recent specimens are not brown, and that the larva is a half looper; but he does not mention its food-plant. Dr. Packard,† who does not mention the sexual differences, quotes Harris as stating on the authority of Abbott, that the larva feeds on the wild Trumpet-creeper (*Bignonio radicans*) in Georgia. But no one has heretofore mentioned its Grape-vine feeding propensities, and it is consequently now added for the first time to our list of Grape-vine depredators, and there are four instead of three bluish caterpillars, all bearing a close general resemblance, which feed upon that plant. They all occur in Missouri, but the present species is far more numerous and destructive than the other three put together. I have now described three of them, and shown wherein they differ from one another, and the fourth, namely, the larva of the Pearl Wood Nymph, is said by Dr. Fitch to so closly resemble that of the Beautiful Wood Nymph that we know not yet whether there are any distinguishing characteristics between them.

PSYCHOMORPHA EPIMENIS, Drury—*Larva.*—General appearance bluish. The ground-color is however pure white, and the apparent bluish cast is entirely owing to the ocular delusion produced by the white with the transverse black bands as in *Alypia octomaculata.* Transversely banded with four black stripes to each joint, the third and fourth being usually rather wider apart than the other two, and diverging at the lower sides where they make room for two more or less conspicuous dark spots placed one below the other; the third on some of the middle joints is frequently broken, with an anterior curve, just above stigmata, and on joints 2 and 3 it is twice as thick as the rest. Cervical shield, hump on joint 11, anal plate, legs and venter, dull pale orange. Joint 1 with about 14 large shiny piliferous black spots, 8 of which form two rows on the cervical shield (those in the anterior row being largest and farthest apart,) and six of which are lateral, namely, three each side, with more or less distinct dusky marks between and in front of them. The spots on the hump are usually placed as at Figure 26, *c*, but vary very much, though the four principal ones on the top are generally placed in a square. The anal plate is marked with 8 such spots, very much as in the cervical shield, but smaller. The tips of the thoracic legs are black and the other legs and venter are also spotted. Head gamboge-yellow, inclining to orange, with 8 principal and other minor black piliferous spots. The ordinary piliferous spots are small, and except two dorsal ones which are in the white space between the second and third band, they are not easily detected. The stigmata are also quite small and round. The abdominal prolegs decrease in size from the last to the first pair, and the larva curves the thoracic joints and is a half-looper, especially when young. Average length about one inch. Described from numerous specimens.

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* Harr. Corr., p. 111.
† Guide, etc., p. 281.

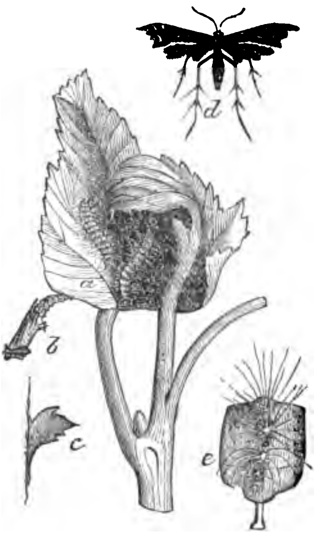
Chrysalis.—Average length 0.37 inch; reddish-brown; rugose, especially on dorsum of abdominal joints, but distinguished principally by the truncated apex, which has a large horizontally compressed ear-like horny projection at each upper and outer edge.

THE GRAPE-VINE PLUME—*Pterophorus periscelidactylus*, Fitch.

(Lepidoptera, Alucitidæ.)

In my first Report a short account has already been given of this insect, but as it was very numerous last spring, and as I had good opportunities of making further observations, I have concluded, by aid of the accompanying figure, to give a more complete account of it.

[Fig. 27.]



In the earlier published Proceedings of our State Horticultural Society reference is occasionally made to "small grey or green worms which feed on the young leaves before blossoming,"* without any definite name being given to them. Husmann, in his "Grapes and Wine," (p. 80) mentions similar worms, and I have little doubt but that the insect referred to is the little Plume we are now considering.

Just about the time that the third bunch of grapes, on a given shoot, is developing, many of the leaves, and especially those at the extremity of the shoot, are found fastened together more or less closely, but generally so as to form a hollow ball. These leaves are fastened by a fine white silk, and upon opening the mass and separating the leaves, one of two caterpillars will generally be found in the retreat. I say one of two, because the retreat made by the smallest of the Blue Caterpillars of the Vine, namely, the larva of the Grape-vine Epimenis (Fig. 26, *a*) which we have just treated of, so closely resembles that of the Grape-vine Plume under consideration, that until the leaves are separated it is almost impossible to tell which larva will be found. Both occur at the same time of year, and both were more destructive than usual the past season in the vicinity of St. Louis. In an ordinary season they do not draw together the tips of the shoots till after the third bunch of grapes is formed, and in devouring the terminal bud and leaves, they do little more than assist the vineyardist in the pruning which he would soon have to give. They act, indeed, as Nature's pruning-knives. But the late and severe frost which killed the first buds last April, so retarded the growth of the vines that the worms were out in force before the third bunch had fully formed, and this bunch was consequently included in the fold made by these worms, and destroyed.

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* Proceedings for 1860, p. 58, and 1861-2, p. 77.

The larva of the Grape-vine Plume invariably hatches soon after the leaves begin to expand; and though it is very generally called the Leaf-folder, it must not be confounded with the true Leaf-folder, which was just now described, and which does its principal damage later in the season. At first the larva of our Plume is smooth and almost destitute of hairs, but after each moult the hairs become more perceptible, and when full grown the larva appears as at Figure 27, *a*, the hairs arising from a transverse row of warts, each joint having four above and six below the breathing-pores * (see Fig. 27, *e*). After feeding for about three weeks, our little worm fastens itself securely by the hind legs to the underside of some leaf or other object, and, casting its hairy skin, transforms to the pupa state. This pupa (Fig. 27, *b*), with the lower part of the three or four terminal joints attached to a little silk previously spun by the worm, hangs at a slant of about 40°. It is of peculiar and characteristic form, being ridged and angular, with numerous projections, and having remnants of the larval warts; it is obliquely truncated at the head, but is chiefly distinguished by two compressed sharp-pointed horns, one of which is enlarged at Figure 27, *c*, projecting from the middle of the back; it measures, on an average, rather more than one-third inch, and varies in color from light green with darker green shadings, to pale straw-color with light brown shadings.

The philosophic student of insect life cannot fail to be struck with the wonderful disguises which these little animals often assume, the better to escape detection from their enemies. The instances of protective mimicry are more numerous among insects than among any other Class of animals, and in the last part of this Report, I shall have occasion to refer to this subject more fully. I had often wondered why the pupa of the Grape-vine Plume was seldom noticed in the open vineyard, and I very well recollect, when three years ago, this worm was abundant in the vineyard of the Rev. Charles Peabody of Glenwood, I. M. R. R., that he one day expressed great astonishment at their total and sudden disappearance. I told him that they had changed to the pupa state and were more thoroughly hidden among the leaves; but he did not succeed in feeding any of the pupæ, and I did not then suspect that we have here a case of mimicry. From some interesting facts communicated to me by Mr. M. C. Read of Hudson, Ohio, I am satisfied, however, that we have here a clear case of protective disguise. He says: "Of a large number raised in jars by me, there were two well defined colors, one a reddish-brown resembling closely the bark of ripe grape wood, the other a light green, or exactly the color of the leaves and young wood. Without an exception the green ones were attached to the green leaves and green wood, or to the sides of the glass jar of very similar color; while all of the brown ones were attached to stems of the ripened grape-wood." Having noted this fact he put large numbers of larvæ in a jar with sticks and material of various colors, but he obtained only the two varieties of pupæ and each was invariably attached to an article of the same color as itself.

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* As Dr. Fitch's description of this larva is the only one I know of, and is rather incomplete, I subjoin the following for the scientific reader:

MATURE LARVA OF PTEROPHORUS PERISCELIDACTYLUS.—Average length 0.50 inch. Color pale greenish-yellow. Joints separated by deep constrictions. Each joint with a transverse row of large cream-colored warts, giving rise to soft white hairs, many of which are slightly clubbed at tip. Four of these warts above, and six below stigmata, the four lower smaller than the six upper ones. The hairs from warts above stigmata diverging in all directions and straight, those from the row immediately below stigmata decurving. Other short and more minute club-tipped hairs spring from the general surface of the body between the warts. Head yellow, with labrum slightly tawny. Legs also yellow, immaculate and very long and slender. Described from numerous living specimens.

So far as I recollect the facts noticed in my own breeding of this insect, they accord with the observations of Mr. Read, and there is no reason to doubt that in a state of nature the green variety confines itself to the leaves, and the brown variety to the wood of the vine. Upon the theory of Natural Selection, *i. e.*, in this case, the preservation of the best disguised specimens, these facts become significant, and it is easy to understand how the two distinct forms would in time inevitably be produced; but whether these singular disguises be explained on that theory or on any other, they are equally interesting and afford good food for the reflective mind.

The moth (Fig. 27, *d*) escapes from this pupa in about one week, and, like all the species belonging to the genus, it has a very active and impetuous flight, and rests with the wings closed and stretched at right angles from the body, so as to recall the letter T. It is of a tawny yellow color, the front wings marked with white and dark brown as in the figure, the hind wings appearing like burnished copper, and the legs being alternately banded with white and tawny yellow.

All the moths of the family (ALUCITIDÆ) to which it belongs have the wings split up into narrow feather-like lobes, and for this reason they have very appropriately been called Plumes in popular language. In the genus *Pterophorus* the front wings are divided into two, and the hind wings into three lobes. As I have shown in my first Report we have a somewhat larger species (*P. carduidactylus*, Riley) which occurs on the Thistle, and which, though bearing a close resemblance to the Grape-vine Plume in color and markings, yet differs very remarkably in the larva and pupa states.

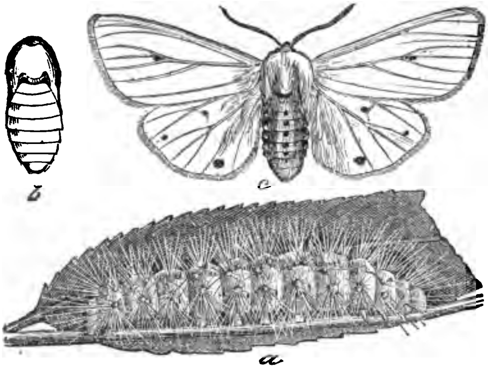
From analogy we may infer that there are two broods of these worms each year, and that the last brood passes the winter in the moth state. I have, however, never noticed any second appearance of them, and whether this is from the fact that the vines are covered with a denser foliage in the summer than in the spring, or whether there is really but one brood, are points in the history of our little Plume which yet have to be settled by further observation.

On account of its spinning habit, which enables us to detect it, this insect is easily kept in check by hand picking.

THE COMMON YELLOW BEAR—*Spilosoma virginica*, Fabr.

(Lepidoptera, Arctiidæ.)

[Fig. 28.]



This is one of the most common North American insects. The moth (Fig. 28, *c*) which is very generally dubbed "the Miller," frequently flies into our rooms at night; and there are quite a number of our farmers who, somehow or other, have got the idea that this "Miller" is the insect that infests their bee-hives—that it is, in short, the Bee-moth. Of course no such ridiculous idea could for a moment prevail among those who read these Reports.

Though the moth is so common, how few persons ever think of it as the parent of that most troublesome of caterpillars, which Harris has so aptly termed the Yellow Bear (Fig. 28, *a*). These caterpillars are quite frequently found on the Grape-vine, and when about one-fourth grown bear a considerable resemblance to the mature larva of the Grape-vine Plume which we have just described. They seldom appear, however, till that species has disappeared, and may always be distinguished from it by their semi-gregarious habit at this time of their life, and by living exposed on the leaf (generally the under side) instead of forming a retreat within which to hide themselves, as does the Plume.

The Yellow Bear is found of all sizes from June to October; and though quite fond of the vine, is by no means confined to that plant. It is, in fact, a very general feeder, being found on a great variety of herbaceous plants, both wild and cultivated, as butternut, lilac, beans, peas, convolvulus, corn, currant, gooseberry, cotton, sunflower, plantain, smart-weed, verbenas, geraniums, and almost any plant with soft, tender leaves. These caterpillars are indeed so indifferent as to their diet, that I have actually known one to subsist entirely, from the time it cast its last skin till it spun up, on dead bodies of the Camel Cricket (*Mantis carolina*).

When young they are invariably bluish-white, but when full-grown they may be found either of a pale cream-color, yellow, light brown or very dark brown, the different colors often appearing in the same brood of worms, as I have proved by experiment. Yellow is the most common color, and in all the varieties the venter is dark, and there is a characteristic longitudinal black line, more or less interrupted, along each side of the body, and a transverse line of the same color (sometimes faint) between each of the joints: the head and feet are ochre-yellow, and the hairs spring from dark yellow warts, of which there are 10 on each joint, those on joint 1 being scarcely distinguishable, and those on joint 12 coalescing. There are two broods of these worms each year, the broods intermixing, and the last passing the winter in the chrysalis state. The chrysalis (Fig. 28, *b*) is formed in a trivial cocoon, constructed almost entirely of the caterpillar's hairs, which, though held in position by a few very fine silken threads, are fastened together mainly by the interlocking of their minute barbs, and the manner in which the caterpillar interweaves them.

The moth makes its appearance as early as the first of May in the latitude of St. Louis, but may often be found much earlier in stove-warmed rooms. It is easily recognized by its pure white color, by its abdomen being orange above, with three rows of black spots, and by the black dots on its wings. These dots vary in number, there being usually two on each of the front and three on each of the hind wings, though sometimes they are all more or less obsolete, except that on the disk of the front wings.

It is fortunate for us that this caterpillar is attacked by a large number of insect parasites; for, were this not the case, it would soon multiply to such a degree as to be beyond our control. I know of no less than five distinct parasites which attack it—some living singly in the body of the caterpillar, and issuing from the chrysalis without spinning any cocoon of their own; others living singly in the body, but forming a cocoon of their own inside the chrysalis of their victim, and still others infesting the caterpillar in great numbers, and completely filling the chrysalis with their pupæ.*

The best time to destroy these worms is soon after they hatch from their little round yellow eggs, which are deposited in clusters; for, as already intimated, they then feed together.

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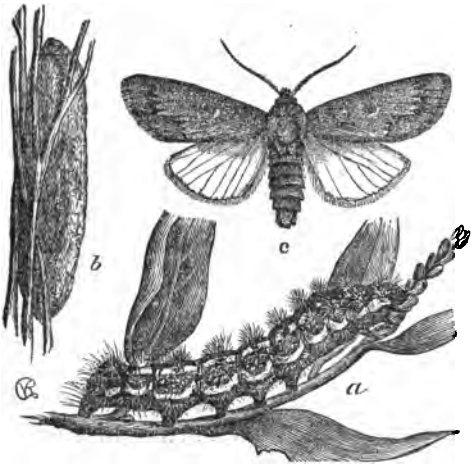
* For the benefit of the scientific reader I enumerate the five parasites which I have ascertained to infest this caterpillar: 1. *Anomalon flavicorne* (Brullé Hym IV, p. 171). 2. *Ichneumon subcyaneus*, Cress. (Proc. Ent. Soc., Phila., III, p. 148), and *Ich. pullatus*, Cress. (Pro. E. S. P.. III, p. 146), described as a distinct species, but *pullatus* is evidently the male, and *subcyaneus* the female of the same species, as I have bred from *Spilosoma virginica* three males all answering to the description of the former, and two females both answering to the description of the latter. 3. *Ichneumon signatipes*, Cress. (Trans. Amer. Ent. Soc,, I, p. 308). 4. *Ophion bilineatus*, Say. (Ent. of N. A., I, p. 379). 5. A small undetermined, and probably undescribed Dipteron belonging to the MUSCADÆ.

THE SMEARED DAGGER—*Acronycta oblinita*, Sm. & Abb.

(Lepidoptera, Acronyctidæ.)

[Fig. 29.]



This is another insect which is occasionally found upon the Grapevine, but never in sufficient numbers to do any considerable harm. It is one of our most common insects, and a very general feeder, occurring on a great variety of herbaceous plants, among others asparagus and cotton, and being especially partial to the common smartweed (*Polygonum hydropiper*). It also feeds on some shrubs and trees, occasionaly proving quite injurious, for Mr. F. A. Nitchy, of Jefferson City, sent me specimens last summer with the statement that they were very numerous on his peach trees, and I have known it to denude both apple and willow trees.

The larva (Fig. 29, *a*) is easily recognized by the distinct wavy bright yellow band at the side, and the transverse row of crimson-red warts and stiff yellowish or rust-red bristles across each joint, in contrast with the black color of the body. When full grown it draws a few leaves or stems together, or retreats into some fence corner, and spins a narrow elongated cocoon (Fig. 29, *b*) generally white, but occasionally inclining to ochre-yellow, some which I have found on Willow being of this last color. The chrysalis is very dark brown, and, with the exception of a smooth shiny band on the posterior border of each abdominal joint, is rough or shagreened. It has the power of violently turning round and round in its cocoon when disturbed, thereby causing a rustling noise. The moth (Fig. 29, *c*) has the front wings of an ash-gray color, caused by innumerable dark atoms scattered over a white ground, and there is a distinct row of black dots along the posterior border, a more or less distinct black zigzag line across the outer fourth, and some dusky spots just above the middle of the wing. The hind wings are pure white.

There are two broods each year, the first brood of worms appearing for the most part during June, and giving out the moths in July, and the second brood occurring in the fall, passing the winter in the chrysalis state, and producing moths the following May.

Handpicking is the only remedy that it has been found necessary to adopt with this caterpillar whenever it becomes troublesome.

There are at least three natural enemies which serve to keep it in check. The largest of these is the Uni-banded Ichneumon-fly (*Ichneumon unifasciatorius*, Say), a large black fly, 0.60 inch long, and characterized by a white annulus about the middle of the antenna, a large white spot about the middle of the thorax, and a white band on the first joint of the abdomen.

This fly oviposits in the larva of the Smeared Dagger, but the latter never succumbs till after it has spun up and become a chrysalis, for I have always obtained the Ichneumon from the chrysalis. The other parasites are smaller and work differently. They each cause the larva of the Smeared Dagger to die when about full grown, and its contracted and hardened skin, which may often be seen during the winter, with the head attached (Fig. 30, *a*), fastened to the twigs of apple and willow trees, forms a snug little house where the parasite undergoes its transformations and through which it gnaws a round hole (Fig. 30, *b*), to escape the latter part of April. One of these flies (*Aleiodes Rileyi*, Cresson,) is described on page 382, of Volume II, of the Transactions of the American Entomological Society, and is of a uniform reddish-yellow color. The other is a black fly of about the same size, but belonging to an entirely different genus, *Polysphincta*. It has two prominent carinæ on the dorsum of the basal joint of the abdomen, and the legs, except the hind tarsi and last half of hind tibiæ are rufous. It is marked *bicarinata* in my MS., but I omit the description as I do not possess the female. The first of these parasites is in its turn preyed upon by a minute *Chalcis* fly of a steel-blue color with honey-yellow legs, which issues in great numbers through a very minute hole, from the dried caterpillar skins.

[Fig. 30]

As I know of no description of *oblinita* in the English language, and as that of Guenèe is rather summary, I subjoin the following:

ACRONYCTA OBLINITA, Sm. and Abb.—*Imago*—Front wings oblong; apex more or less prolonged; posterior margin sometimes rounded, sometimes straight; color ash-gray, caused by numerous dark brown atoms more or less suffused on a white ground, from which the ordinary lines are barely discernible in the better marked individuals; a row of distinct black dots along posterior border; the ordinary spots represented by blurred marks or entirely obsolete; the undulate line across posterior fourth of wing distinct, and relieved inside by a pale coincident shade, with the teeth quite aciculate and with the psi-spot so characteristic of the genus, but rarely traceable; fringe narrow and generally entire. Hind wings pure white, with a faint row of dark spots around posterior border. Under side of both wings white with faint fulvous tint and faint irrorations; each wing showing the brown discal spot and the row of points at posterior border. Head and thorax speckled gray; abdomen whitish-gray; antennæ short, simple in both sexes, gray above and brown below; palpi small. Two specimens with the front wings very dark, showing the ordinary lines and spots conspicuously, and with the antennæ brown above as well as below. Average length, 0.75; expanse, 1.75 inches.

Described from numerous bred specimens.

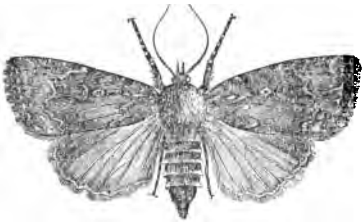
Larva—Prevailing color black. Each joint with a transverse dorsal crimson-red band across the middle from stigmata to stigmata, and containing six warts, each furnishing 10 or 12 or more stiff yellow or fulvous bristles, and the two dorsal ones being farthest apart. A sub dorsal longitudinal yellow line interrupted by this transverse band and at incisures, in such a manner that the black dorsum appears somewhat diamond-shaped on each joint. A broad, wavy, bright-yellow stigmatal line, containing a yellow bristle-bearing wart in middle of each joint. Lateral space occupied with different sized pale yellow spots, largest towards dorsum. Head chesnut-brown. Venter crimson-black, with bristle-bearing warts of same color. Stigmata oblong-oval and pale. Thoracic legs black; prolegs with black extremities. Such is the normal appearance of this larva, but it is very variable. In some the yellow seems to predominate over the black, and there is a more or less distinct dorsal line. In some this dorsal line forms a mere speck at the incisures of the middle joints. The transverse crimson band is often entirely obsolete, and the warts distinctly separated, while in others where this band is distinct, the warts frequently coalesce.

Pupa—Almost black, and shagreened with the exception of a smooth and polished rim, at posterior border of joints, which becomes reddish, especially ventrally, on the three joints immediately below wing-sheaths. Terminal joint horizontally compressed, squarely cut off, and furnished with a little brush of short evenly-shorn, stiff rufous bristles.

THE PYRAMIDAL GRAPE-VINE WORM.—*Amphipyra pyramidoides*, Guen.

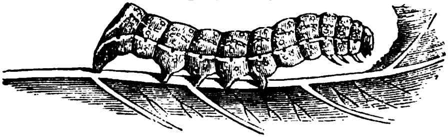
(Lepidoptera, Amphipyridæ.)

[Fig. 31.]



Another worm, never hitherto mentioned as injurious to the Grape-vine, is often found resting upon it in the posture shown in Figure 32, and may be at once distinguished from all others that are known to attack it, by having a pyramidal hump near the end of its body. This worm I have also found upon the Red Bud (*Cercis canadensis*), the Raspberry and the Poplar, but it is only as a vine-feeder that it can be considered injurious. It was more abundant in the summer of 1869 than it has been since. According to the experience of Mr. G. Pauls, of Eureka, it takes the Hartford, Israella and Iona first, and the Concord and North Carolina next, and devours the blossoms as well as the leaves. It is of the form shown in the figure and of a delicate green color, marked with pale yellow or cream-colored lines and spots, as there indicated. It is found on the vines during the month of May with us, and during the forepart of June descends to the surface of the ground, where it spins a loose cocoon of whitish silk, generally constructed between some fallen leaves. Within this cocoon it remains some time in the larva state, but eventually becomes a shiny mahogony-brown chrysalis from which emerges a moth (Fig. 31), with the front wings bark brown and glossy and marked with dark brown and pale grayish-brown as in the cut; and with the hind wings of a lustrous copper color, from which character it may be called in popular language the American Copper Underwing. In Chicago, Illinois, this insect is single-

[Fig. 32.]



brooded, for a poplar-feeding larva found the latter part of May, and which spun up on the 14th of June, did not produce the moth till the following April; but specimens obtained near St. Louis often produce the moth during July of the same year that they are found as worms. In this last case a second brood is doubtless produced the same year though it is barely possible that the moths winter over and do not deposit till spring; for they are characterized by having very flat bodies, and with their wings folded flatly on their backs they are often found hiding in narrow cracks and crevices where they seem to love to shelter.

There is an insect (*Amphipyra pyramidea*, Linn.) very common throughout the continent of Europe, on Elm, Poplar, Oak, and other trees, and known in England as the Copper Underwing, which our *pyramidoides*, as its name implies, so very closely resembles in all its stages, that it is difficult for one who has become acquainted with both insects in the field, to bring himself to believe that they are really distinct species. No one can behold the two moths and speculate on their great similarity, without feeling that such close resemblance between the insects of two continents is hard to account for on any other theory than that of community of descent; or without questioning whether there really are differences enough to make two species, when he reflects that far greater variations often occur in the particular species of a given continent! The most constant difference seems to occur in the larvæ which, though they agree in almost every other detail, differ in the European species having the pyramidal hump more strongly developed and capped with a red horn-like point which curves backwards, while in our species this point is more or less obsolete and not red.

REMEDIES.—This worm is easily kept in check by hand-picking, and though its moth is attracted by sweets, it has never been numerous enough in the past to warrant this mode of capturing it. We have no good description of this insect in the English language, so I subjoin one.

AMPHIPYRA PYRAMIDOIDES, Guen.—*Larva*, (Fig. 32.)—Length when full grown 1.20–1.30 inch. Smallest at joint 1, largest at joint 11 which rises pyramidally above the others. Color pale bluish-green inclining to whitish dorsally, and rather darker at each end than in the middle of body. A continuous narrow cream-colored medio-dorsal line extending from the head to extremity of anal shield; a subdorsal line of the same color or somewhat more yellow, wavy and broken into 4 or 5 unequal spots on each of joints 1–10, more or less distinct, ascending continuously on joint 11 to the summit of pyramid, descending in a curve and vanishing in the anal shield; a broader stigmatal line, bright sulphur-yellow, except where intercepted by stigmata where it is white, distinct on joints 1 and 2, less so on 3 and 4, and running straight to the extremity of anal shield. Looking downwards from the top of the pyramid, six lines seem to radiate from it in as many different directions. Besides these lines, each joint has about ten cream-colored piliferous spots, namely, 4 in dorsal space—the anterior ones nearest together—one in the middle of each joint in subdorsal space, and 2 smaller substigmatal ones. These spots are more or less obsolete on the thoracic and anal joints; they are arranged transversely on the former, and the hairs arising from them are so insignificant that they are scarcely visible. Stigmata white, with a black annalation. Head free, smaller than joint 1, concolorous with body. Venter darker green with cream-colored points. Legs of the same color, the thoracic with three brown, or black spots outside, the prolegs with purplish clingers. Described from two grape-feeding, two poplar-feeding specimens.

Pupa.—Highly polished mahogony-brown, rather short and thick, impunctate, and with two small short spines and several fine curled bristles at the extremity.

Imago.—*Front Wings,* with the costal margin more or less arched and the posterior margin more or less scalloped or dentate; general color brown, being variegated with a pale glossy gray, with more or less fulvous, glossy purple-brown and unpolished purple-black; the transverse anterior nearly obsolete or tolerably well defined, in strong zigzag, pale with a dark shade each side; reniform spot entirely obsolete, or well indicated and pale; orbicular small and illy defined, or large and forming a pale ring with the centre sometimes concolorous, sometimes lighter than median space, and with the basal side sometimes, not always, extended into a beak or point; transverse posterior well relieved inside but not outside, except at costa; it starts distinctly about the middle or a little outside the middle of costa, runs outwardly at right angles along costal nerve, either its own width or twice its width, thence obliquely outwards towards the middle of the wing, with a more or less conspicuous inward jog or curve in discoidal cell; thence across the wing in 4 undulations: in some specimens it makes an obtuse angle, so that the inner half runs parallel with the posterior margin, in others it runs almost straight across the wing, so as not to be parallel with the margin at any point; in some it traverses the wing so as to leave a full third, in others so as to leave only a fourth of the wing outside; subterminal line pale and broken, scarcely distinguishable, or well defined, especially at costa, where the apical space is pale and blends with it, or as brown as the rest of wing and relieves it; a series of 8 more or less distinct pale terminal dots, often relieved by an outer black shade, fringes concolorous: sometimes with a pale middle line often broken and appearing like a second series of dots; the posterior median space is the darkest, and the subterminal space the lightest portion of the wing, though the contrast is often very slight. In one dark specimen the sagittate spots and a longitudinal shade in the discoidal cell and another below the sub-median nerve—the two dividing the wing in three equal parts longitudinally—are very conspicuous from their being very dark and without gloss; in two specimens these marks are entirely obsolete; under surface smoky-gray, more or less suffused with fulvous, and with a dark shade below transverse posterior. *Hind wings* bright glossy cupreous, or with but a very faint tint of this color, and more or less distinctly grayish-brown along the costa to the third superior nerve and the upper posterior border; fringe scalloped, grayish-brown, with an inner paler hue; under surface more or less concolorous, with the lunule indicated and with a broad line, half black, half cupreous. *Thorax,* with the scales large and mixed fulvous and brown. *Abdomen,* with the sides dark, intercepted by the fulvous margins of joints; anal tuft more or less rufous. *Legs* with the tibiæ and tarsi alternately fulvous and brown. Expanse 1.65–1.90 inches.

Described from four bred and four captured specimens.

The differences between the European *pyramidea* and this species, as given by Guenée, are: First, In *pyramidea* the transverse posterior curves outward near the costa, so as to produce an inward sinus in the discoidal cell, while in *pyramidoides* it runs nearly straight and obliquely; Secondly, in *pyramidoides* this line is said to border a median space almost always darker than the rest of wing and absorbing the darker longitudinal lines, while the light lines are given as narrower than in *pyramidea*, and the subterminal more continued to costa, where it borders, or cuts, as Guenée has it, a light apical space. While the difference mentioned in the transverse posterior is tolerably constant in the eight specimens of *pyramidoides* in my possession, I have seen two in other collections where this line was almost a fac-simile of the same line in *pyramidea*; and the other characters, as will be seen from the above description are quite variable, sometimes approaching the typical *pyramidea* and sometimes the typical *pyramidoides*. The same variations doubtless occur in the European species, for if we can rely on Mr. Edward Newman's figure (British Moths, p. 457,) the median space is sometimes as much darker than the subterminal in their insect as it is said, by Guenée, to be in ours Upon critically examining two European specimens of *pyramidea* in the collection of my friend, Mr. A. Bolter, of Chicago, I find this shade very distinct on the posterior portion of the median space, but instead of closely bordering and relieving the transverse posterior it fades somewhat before reaching it. The transverse posterior crosses the wing nearer the middle than in our species, leaving, in one of the specimens, more than one-third of the wing outside. But the distinguishing features which struck me as less subject to variation than those mentioned by Guenée, are the somewhat more elongate wings and the broader, more distinct, subterminal line of *pyramidea*. I have little doubt, however, but that from a hundred specimens of each species at least one *pyramidea* and one *pyramidoides* could be found that were undistinguishable in themselves. The undersides of the two species agree entirely.

There is but one other described, N. A. *Amphipyra,* namely, the *A. inornata* of Grote—(*Pro Ent. Soc, Phil.,* III, p. 86,) which upon the very face of it, seems to be but a small variety of *pyramidoides,* as will be seen by comparing his description with that found above. The species was described from a single specimen belonging to Mr. Wm. Saunders, of London, Ont., who agrees with me in believing it to be but a variety of *pyramidoides.*

I have a unique in my cabinet which differs so remarkably in the front wings from *pyramidoides* that I feel constrained to briefly describe it, and yet in all other characters it so closely resembles that species that I should hesitate to do so, had I not bred it from the larva. It looks exactly as though something had been sprinkled uniformily over the front wings and had eaten the dark color away in spots and splashes, but the specimen is in reality perfect, with not a scale ruffled. It may be called the Spattered Copper Underwing:—

Amphipyra conspersa, N. Sp.—*Larva.*—Found full grown July 2nd, 1867 on Hazel. No pyramindal hump, and of a uniform emerald-green, the dorsal palpitations visible and the stigmata pale with a black annulation, but with no other markings either on the head, body or legs.

Imago—Like *pyramidoides* in every particular except that the brown of front wings is almost uniformily spattered over, more or less suffusely with pale grayish spots so that no regular marks appear. The costal marks are however tolerably distinct as in *pyramidoides* and by careful examination and comparison, traces of the more conspicuous marks of that species may be discerned.

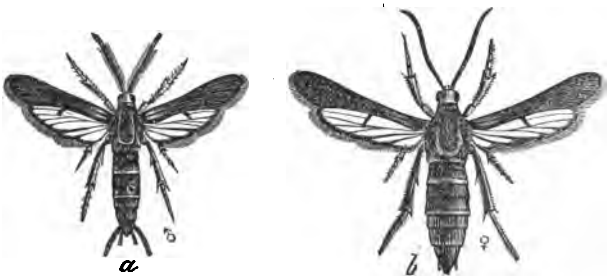
Described from one ♀ bred July 31st.

THE GRAPE-ROOT BORER—*Ægeria polistiformis*, Harr.

(Lepidoptera, Ægeridæ.)

The most common root-borers of the Grape-vine in this State are those which I have termed Gigantic Root-borers, namely, the larvæ of two large beetles (*Prionus laticollis* and *P. imbricornis*) which were treated of in my previous Reports. The insect now under consideration is a moth and not a beetle and has for a number of years been known as THE Grape-root Borer. It bears a very close resemblance to the common Peach Borer, both in habit, and in the size and general appearance of the larva, but it is a somewhat larger insect and the moths differ materially.

[Fig. 33.]



It has usually been considered a Southern insect and certain it is that it is not as destructive in the vineyards of Missouri as the Gigantic borers. But I captured specimens of the moth and found the larva in St. Louis county last summer, and it has long been known to be destructive throughout Kentucky. It was also reported around Cincinnati in 1867, though there is no evidence that the insects attacking vine roots there were this species and not the Gigantic borers.

The larva can easily be distinguished from the Gigantic root-borers, by having 16 legs as in all normal Lepidopterous larvæ, namely, six true horny legs head near the and ten false or membranous legs, eight of which are in the middle and two at the end of the body. When full grown it measures from an inch to an inch and three-quarters, and it then forms a pod-like cocoon of a gummy sort of silk covered with little bits of wood-bark and dirt, within or adjacent to the injured root. Within this cocoon it becomes a chrysalis which, in due time, by aid of rows of minute teeth with which it is furnished, works its way out of the cocoon to the surface of the ground, and gives forth the moth. As with the Peach Borer, this insect requires a year to develop and is found in its different states of larva, chrysalis and moth, throughout the summer months, and it doubtless also passes the winter as a larva.

The moth looks very much like a wasp and especially like some belonging to the genus *Polistes*—whence its specific name—and the resemblance becomes still more striking when flying, for its flight is accompanied by a buzzing wasp-like noise. The sexes differ considerably though not as much as in the case of the Peach Borer. The colors are dark brown and tawny-orange, and the male is well represented at Figure 33, *a*, and the female at *b*, but as the description which was published seventeen years ago by Harris, and copied by Mr. Walsh in his Report, is brief and defective, I subjoin one which is more complete:—

ÆGERIA POLISTIFORMIS, Harris,—*Imago* ♀—*Head,* including the palpi, orange-tawny. Antennæ simple, blue-black; orange-tawny above at their extreme base and tip and below for their entire length. *Thorax* black; varied with orange-tawny and bright yellow on the lateral and posterior surface above, and below for its entire surface. *Abdomen* generally with the four basal joints black and the rest orange-tawny; sometimes almost entirely orange-tawny; sometimes almost entirely black; always with a narrow yellow ring at the tip of the second joint above and generally with another such ring at the tip of the fourth joint; venter mostly black with the tip of all the joints more or less edged with orange-tawny, and with a short lateral pencil of orange-tawny hairs springing from the tip of the penultimate joint below, and reaching a little beyond anus. Legs orange-tawny above, mostly black below but with a yellow patch at the origin of the middle spurs on the hind tibiæ. All the spurs and tarsi more or less tinged with yellow. Front wings brown-black with a more or less distinct clear space at base, longitudinally traversed by a nervure; hind wings hyaline, with the veins, the terminal edge and the fringe, brown-black. Length 0.66—0.85 inch; expanse 1.15—1.50.

The ♂ differs from the ♀ as follows:—1st. The antennæ are bipectinate four-fifths of the way to the tip, which is strongly clavate and, as in the ♀, bears a few hairs at its apex. The bipectinations are fully one-fourth as long as the head is wide, and, as well as the entire basal half of the antennæ are orange-tawny. 2nd. Both thorax and abdomen are darker, and in addition to the pair of short anal pencils below, there is a pair nearly twice as long above. 3rd. The short hyaline space straddling a black nervure at base is more distinct. Length 0.68 inch; expanse 1.10 inch.

Described from 1 ♂ 1 ♀ bred July 8th—16th, from grape roots, and others captured during August at Kirkwood, Mo. It is remarkable that although Dr. Harris chronicles in his correspondence with Dr. LeBaron, as a notable event, his having captured an *Ægeria* with pectinate antennæ in New England in 1850,* in 1854, when for the first time he described the moth of our Grape-root borer, he did not say a single word about the ♂ antennæ being bipectinate, if we are to judge from the account he gives in a Report made to the American Pomological Society in 1854 (p 10.) Either his ♂ specimens had lost their antennæ, or the pectinations were rubbed off, the former being the more likely occurrence. Certain it is that the males received by Dr. Harris once had pectinated antennæ, for though Mr. Glover, copying after Harris, likewise fails to mention this sexual character in his account published in the Patent Office Report for 1854 (p. 80), he nevertheless plainly figures the pectinations (Ibid, Pl. 6, lower right hand figure) and the specimens from which he made the figure were received from the very same person who furnished Dr. Harris with his specimens.

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*Harris correspondence, p. 262.

Unlike the Peach Borer which makes its abode quite near the surface, this borer lives exclusively under ground, and unlike the Gigantic root-borers which hollow out and bore up along the heart of the roots, it confines itself almost entirely to bark and sap wood, and the effects of its work are consequently more fatal to the vine. Roots attacked by it, to use one of Mr. Walsh's expressions, look "as if a drunken carpenter had been diligently scooping away the sap-wood with a quarter-inch gouge." It must, however, sometimes hide under the bark of the roots, as Mr. H. J. Kron of Albemarle, North Carolina, in the Monthly Report of the Department of Agriculture for 1867, (p. 329), describes it as being shielded by the bark.

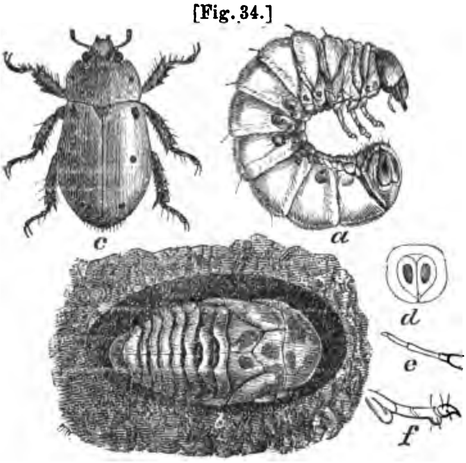
REMEDIES—It has been ascertained by observation and experiment that the Scuppernong grape-vine—which, according to Gray, is a cultivated variety of the Southern Fox Grape (*vitis vulpina*)—is never attacked by this borer, and consequently that other varieties grafted on to the Scuppernong share its immunity from attack. This is a very easy mode of preventing its ravages in the more Southern States where the Scuppernong flourishes; and if this borer should ever become very numerous with us, it may be deemed advisable to introduce that stock here. At present we have no other preventive than mounding, and the insect is so comparatively scarce that I have not yet had an opportunity of testing whether such mounding would work as well as it does with the Peach Borer. When it is once ascertained that the borers are at work on a vine, they may be destroyed by clearing away the earth and applying hot water to the roots.

THE SPOTTED PELIDNOTA—*Pelidnota punctata*, Linn.

(Coleoptera, Scarabæidæ.)

This is the largest and most conspicuous beetle that attacks the foliage of the Grape-vine, and in the beetle state it seems to subsist entirely on the leaves of this plant, and of the closely allied Virginia Creeper. Though some years it becomes so abundant as to badly riddle the foliage of our vineyards, yet such instan-

[Fig. 34.]



ces are exceptional; and it usually occurs in such small numbers, and is so large and clumsy, that it can not be considered a very redoubtable enemy.

Its larva has, for a number of years been known to feed on the decaying roots of different trees, but was first described by me last September.* It is a large clumsy grub (Fig. 34, *a*) bearing a close resemblance to the common White Grub of our meadows, and it differs from that species principally in being less wrinkled, and in having the chitinous covering (or skin, so-called) more polished and of a pure white color, and in the distinct heart-shaped swelling above the anus (Fig. 34, *d*). Towards the latter part of June I have found this larva in abundance, in company with the pupa (Fig. 34, *b*), in rotten stumps and roots of the Pear. In preparing for the pupa state, the larva forms a rather unsubstantial cocoon of its own excrement, mixed with the surrounding wood. The pupa state lasts but from eight to ten days, and the beetle (Fig. 34, *c*) is found on our vines during the months of July, August and September. It is not yet known how long a time is required for the development of the larva, but from analogy we may infer that the insect lives in that state upwards of three years.

This beetle was named about a century ago by Linnæus who met with a specimen in the magnificent collection of shells and insects belonging to Queen Louise Ulrica of Sweden. It occurs throughout the States and Upper Canada, and is even met with in the West Indies. It flies and feeds by day, and is most abundant during the months of July and August. The wing-covers are of a slightly metallic clay-yellow color, with three distinct black spots on each, and the wings themselves are dark-brown inclining to black; the thorax is usually a little darker than the wing-covers, with one spot each side; the abdomen beneath, and legs, are of a bronzed-green. It is easily kept in check by hand-picking.

PELIDNOTA PUNCTATA, Linn.—*Larva* (Fig. 34, *a*)—Length 2 inches; clumsy, moving on the side. *Head*, bright chestnut-brown, smooth, rounded, with a short, impressed, longitudinal line on the top, and three shallow impressions in front; epistoma trapezoidal and darker; labrum rough, irregularly punctate, and beset on the margin with a few stiff rufous hairs; antennæ (Fig. 34, *e*) as long as epistoma and labrum together, 4-jointed exclusive of bulbus or tubercle in which they are inserted; joints cylindrical, proportioned in length as 2, 6, 4, 1, the terminal joint being often a mere bud; mandibles strong and black, with three denticulations at tip, and a very slight tooth at inner basal portion; maxillæ brown and subcylindrical on outside, angulated on inside, bearing two lobes, each terminating in an inwardly-curved corneous tooth, and each furnished on their inner narrow edge with stiff bristles, the outside one arising close by base of palpus, the inside one extending lower down, and recalling by its form, the terminal joint of the front leg of a scorpion; maxillary palpi 4-jointed, joints cylindrical, short, very gradually longer and longer from 1 to 4, the terminal joint more pointed and narrower than the others; labium quadrangular, labial palpi 2-jointed, the palpigerous piece strongly beset with bristles. *Body*, smooth with but a few wrinkles at thorax; polished translucent white, with faint bluish marblings on all but thoracic joints which are slightly narrower than the rest; a narrow vascular dorsal line, and a very slight yellowish horny plate in a depression on joint 1; a very slight pubescence observable, and a transverse tergal row of sparse but tolerably long hairs on posterior part of each joint; more dense and conspicuous hairs on lower sides of anal joint, which joint is short, cut off squarely, with a heart-shaped swelling [Fig. 34, *d*) sunk into a circular depression, each lobe of the heart with a darker oval corneous elevation; spiracles sub-elliptical, dark chestnut-brown, placed on a prominent swelling, the lateral openings *all* facing the head, the 1st on joint 1, the rest on joints 4, 5, 6, 7, 8, 9, 10 and 11, gradually becoming smaller and smaller from first to last. *Legs* (Fig. 34, *f*) horny, light-brown and covered sparsely with hairs; coxæ long and stout, with a rounded swelling at lower anterior edge; femora cylindrical, sometimes, distinctly, at others indistinctly, separated from tibiæ, sometimes prolonged into a thorn below, with a distinct carina along the inside, at others not; tibiæ cylindrical, incrassated anteriorly, especially below; tarsi cylindrical and terminating in a distinct claw.

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* See American Entomologist and Botanist, Vol. I, p. 295.

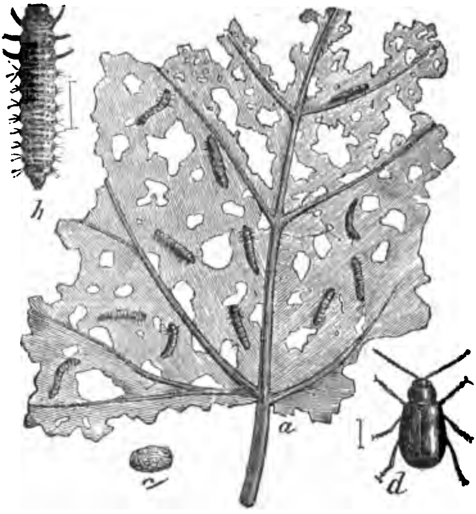
Pupa (Fig. 34, *b*) of the form of *Lachnosterna.*

Described from 12 living specimens.

THE GRAPE VINE FLEA-BEETLE—*Haltica chalybea*, Illiger.

(Coleoptera, Chrysomelidæ.)

[Fig. 35.]



Is there a grape-grower in the State of Missouri who does not know, to his sorrow, what the Grape-vine Flea-beetle is? Hardly one! And yet how few ever connect it with its disgusting little shiny brown larvæ, which generally prove still more injurious than the beetle, by riddling the leaves in the middle of the summer.

The Grape-vine Flea-beetle (Fig. 35, *d*)often goes by the cognomon of "Steel-blue Beetle," and is even dubbed "Thrips" by some vineyardists. The latter term, however, is entirely inapplicable.* The former name is not sufficiently characteristic, because the color varies from steel-blue to metallic-green and purple, and because there are many other flea beetles to which it would equally apply.

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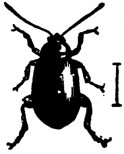
* The term *Thrips* is confined to an anomalous group of insects—mostly cannibal, but exceptionally vegetable feeding—of which Halliday made a separate Order (*Thysanoptera*), but which are to-day included in the *Homoptera*, or Whole-winged Bugs, by most authors, though they seem to have close affinities to the *Orthoptera*, and to the *Pseudoneuroptera*.

The Grape-vine Flea-beetle is found in all parts of the United States and in the Canadas, and it habitually feeds on the Alder (*Alnus serrulata*), as well as upon the wild and cultivated Grape-vine. Its depredations seem first to have been noticed in 1831, by Judge Darling, of Connecticut, and in 1834 Mr. David Thomas, of New York, published an account of it in the 26th volume of Silliman's *American Journal of Science*. Its transformations were, however, unknown till some time after Dr. Harris wrote his excellent work on Injurious Insects, and the figure of the larva was first published by myself last fall.

The beetles hibernate in a torpid state under any shelter which is afforded them in the vineyard, such as the loose bark and crevices of stakes, etc., etc., and they are roused to activity quite early in the spring. The greatest damage is done by them at this early season. for they often bore into and scoop out the unopened buds, and thus blight the grape-grower's bright expectations. As the leaves expand, the little jumping rascals feed on the leaves, and soon pair and deposit their small orange eggs in clusters, very much as in the case of the Colorado Potato-beetle. These eggs soon hatch into dark-colored larvæ, which may be found of all sizes during the latter part of May and early part of June. They are generally found on the upper surface of the leaf, which they so riddle and devour as to give it the appearance represented at Figure 35, *a*. When very numerous they devour all but the very largest leaf-ribs, and I have seen the wild vines throughout whole strips of country rendered most unsightly by the utter denudation which these insects had wrought. The larvæ feed for nearly a month, and when full grown present the appearance of Figure 35, *b*, the hair line at the side showing the natural size. They then descend from the vine and bury themselves a short distance in the earth, where, after each forming a little earthen cell (Fig. 35, *c*), they change to pupæ of a deep dull yellow color, and in about three weeks more issue as beetles. These beetles leave the ground from the middle of June to the middle of July, and, so far as I am aware, do not breed again till the following spring—there being but one brood each year. They subsist on the leaves during the fall, but the damage they inflict is trifling compared to that which they cause in spring.

[Fig. 36.]



Like all other Flea-beetles, this species has very stout, swollen hind thighs, which, though hidden in Figure 35, *d*, are well represented in the accompanying cut (Fig. 36). By means of these strong thighs they are enabled to jump about very energetically, and are consequently very difficult to manage during the summer months. In the winter time, however, they can be destroyed in great numbers while hidden in a torpid state in their retreats, for Dr. E. S. Hull, of Alton, Illinois, tells us* that they were once so numerous in a small vineyard of his that in the spring of 1867 he burnt them out by surrounding them with fire, and letting the fire run through the dry grass in the vineyard. "It was a rough remedy, but as his crop was destroyed, he let the beetles follow suit." Clean culture and general cleanliness in a vineyard will, to a great extent, prevent this insect's increase. Especially should the stakes be clean and free from old bark.

The larvæ can be more easily destroyed by an application of dry lime, used with a common sand-blower or bellows. This has been found to be more effectual than either lye or soap-suds, and is withal the safest, as lye, if used too strong, will injure the leaves.

This insect, like so many others, will one year swarm prodigiously, and then again be scarcely noticed; and such changes in its numbers depend mainly on conditions of the weather, as no parasite is known to attack it. In the spring of 1868, though they were at first out in full force, yet after some subsequent severe and cold weather, they had mostly disappeared. They are apt to be most troublesome where Alder abounds in the woods.

HALTICA CHALYBEA, Illig.—*Full-grown Larva.*—Length, 0.35 inch. Head polished black. Body livid-brown above, paler beneath; subcylindrical, the joints bulging, especially at sides, and each divided superiorly into two transverse folds; on each fold a row of six shiny-black elevated spots, the dorsal ones larger than the others, and often (especially the posterior two) confluent, or divided only by a very narrow dorsal line; each spot giving rise to a single short stiff hair; one such substigmatal black spot placed in middle of joint, and more elongated than the rest, being apparently composed of two confluent ones, as it gives rise to two hairs. Three ventral spots, one anteriorly, which is large, transversely-elongate, central, and without hairs; and two posteriorly (one each side) which are small and piliferous. Six black thoracic legs, and one anal orange proleg.

Pupa.—Length, 0.14 inch. Of the normal Chrysomelid form. Deep dull yellow, and covered more or less above with short black bristles arranged in a transverse row across each joint, and each arising from a slight elevation: two stouter anal bristles or thorns. Eyes brown. Tips of jaws brown.

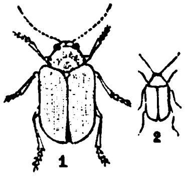
Described from numerous living specimens.

THE GRAPE-VINE COLASPIS—*Colaspis flavida*, Say.

(Coleoptera, Chrysomelidæ.)

There is a little clay-yellow beetle (Fig. 37, magnified, natural size), which does great injury to the Grape-vine by riddling the leaves. It is more or less abundant with us every year, but judging from recorded accounts is still more injurious in the Eastern States, and especially in New York. In the *Country Gentleman* for August 30th, 1866, occurs the following account of it by Dr. Fitch, in answer to a correspondent who wrote that they were destroying grape-vines by the wholesale:

[Fig. 37.]



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* Proc. Alton Hort. Soc. for May, 1867.

"The rascals alluded to are a beetle of the Chrysomela family, and are the Brown Colaspis,* *Colaspis brunnea*, Fab. It is an oval, drab-colored beetle, nearly twice as long as broad, and nearly two-tenths of an inch in length, having the outer edge of his wing covers black, and also the under side of its body and the tip of its antennæ. It is rather a common insect throughout the United States, appearing in the latter part of June, each year, and continuing through the month of July. I have frequently gathered it from the wild grape-vine, the Cinquefoil or Potentilla, and some other plants, but have never known it to invade the cultivated grape until this year.

It has this season been the worst enemy that has attacked the vine in my neighborhood—riddling the leaves with small round holes, interspersed with large irregular ones—and I hear of it in several other parts of the country. * * *

Wherever the Leaf-folder (Fig.24) abounds, this beetle will almost invariably be found in conjunction with it in the fold of the leaf. On finding it so invariably in this fold, I at first supposed that it merely took advantage of the position for shelter, little suspecting that it would feed upon the worm, since the family to which it belongs is essentially herbivorous, and the Leaf folder is so very active; but from having found numbers of the shrunken and half-dead worms, I was led to conjecture that it does actually prey upon them; just as many true bugs (*Hemiptera*) though living naturally on the juices of plants, will still appropriate and relish those of certain caterpillars. Thus may one great pest serve to check another!

Of the natural history of this beetle nothing has hitherto been known. As the beetle was often found upon and greedily devours the leaves of the Strawberry, and as a white worm was known to injure the roots of that plant, I inferred several years ago (Prairie Farmer Annual 1868, p. 56), that this worm was the larva of the Colaspis. From the facts, however, that the larva of the European *Colaspis barbara* was described as a hexapod, blackish, glabrous grub living unprotected upon the leaves of lucern and clover,* and that such was the character of the larvæ of most other insects belonging to the great *Chrysomela* family, I had little confidence that my reference would prove the correct one. Yet it so proved to be, and I have bred the beetle from larvæ infesting strawberry roots that were kindly sent to me by Mr. J. B. Miller, of Anna, Ills. Just as in the European Turnip Flea-beetle (*Phyllotreta nemorum*), the larva mines the leaves above ground, while in our very closely allied Striped Flea-beetle (*Phyllotreta striolata*, Illig.), it feeds upon the roots below ground; so there seems to be the same difference of habit in the genus *Colaspis*. In this last case the difference is not only of habit, but the structure is modified in accordance with the habit, and we have in our Grave-vine Colaspis a Chrysomelid larva bearing a very close resemblance to that of a Lamellicorn.

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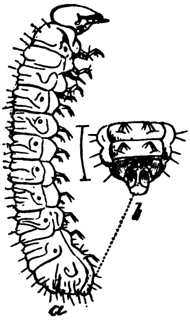
* Dr. Fitch referred this insect to *brunnea*, Fabr., and Mr. Walsh (*Practical Entomologist*, II, p. 68) criticised his course, and referred the species to *flavida*, Say. I adopt Say's name simply because it best indicates the general appearance of the insect, and not because I think Mr. Walsh was right in his strictures. I have kindly been allowed to examine Dr. Fitch's specimens; have examined specimens in other large Eastern collections, and those in the Walsh collection, and am convinced that the difficulty between the above two authors arises from the confounding of varieties with species. It is here, as in almost every other genus and Family, the closet systematist divides up and arranges with insufficient knowledge of the variation which species are subject to, and this was especially the case in years gone by, when every little colorational difference was generally supposed to be immutable. The naturalist, therefore, who studies insects for other and more laudable purposes than the mere naming and classifying of them, though fully aware of the importance and necessity of good and clear nomenclature, may well despair of bringing order out of the confusion which often exists, and which the miserably short and incomplete descriptions of older authors have had much to do in causing. The economist can spend his time more profitably, and so long as he always adds the authority to the name he uses, there will be no danger of causing more confusion, and he can coolly disregard the interminable disputes between different authors as to the proper technical name by which an insect should be known. In the present case, I simply give it as my opinion that *brunnea*, Fabr., *suilla*, Fabr., and *flavida*, Say, are all varieties of one species, because specimens according with each are found in the same vineyard, and because Say himself gives a variation in *flavida*, which differs much more from his description than does either *brunnea* tor *suilla*. Mr. Walsh gives the antenna of *flavida* as having the last joint or two, and the tip of the last joint but four, brown-black, but there is variation here, and the dark color on the last joint but four is often obsolete. The exterior edges of the elytra are either concolorous or of all shades of brown to black, and the same may be said of the sutural edges. There is also a somewhat larger form, which must certainly be referred to the same species, which has the punctures so much less profound as to give it a much smoother and more highly polished appearance.

It is indeed a most singular larva, and differs from all others with which I am acquainted, in having on the underside of the legless joints a pair of curious fleshy projections reminding one of legs, and terminating in about two stiff hairs (Fig. 38, *a*). The office of these appendages it is difficult to conjecture, for they seem to impede rather than aid in locomotion on a flat surface, though, when the habits of the larva are more critically studied, these appendages will doubtless be found to subserve some useful purpose. The color of this larva is yellowish or grayish-white with a gamboge-yellow head. The pupa is formed in the ground and exhibits no unusual characters.

[Fig. 38.]



We are now only treating of this insect as a Grape-vine pest; but it is difficult to say whether the Crown-borer (Fig. 14) or this root-eater is the most injurious to the Strawberry. The work of the two is essentially different, the white Crown-borer confining itself to the crown, and its more dingy ally devouring the fibrous roots and working into the more woody parts from the outside. At this work several of them may frequently be seen with their heads stuck into different parts of one root. They may be found upon the roots all through the fall, winter and spring months, and do not begin to change to pupæ in this latitude till about the month of June, the beetles appearing during that month and continuing to issue from the ground till towards fall. As soon as they issue from the ground they commence to feed upon the tender leaves, and in a measure injure the plants by riddling them with holes. After feeding for a while on strawberry leaves, and depositing their eggs, they spread on to other plants and are generally found most numerous in the vineyard during the latter part of July and during August, where, according to Mr. Miller, they show a partiality for the leaves of the Delaware.

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*Notice sur les Devastations de la Larve du *Colaspis barbara*, par M. Leon Dufour—Annales de la Soc. Ent. de France, 1836, pp. 371—372.

Such, in brief, is the history of this common beetle, as far as I have been able to trace it. It doubtless has natural enemies, and ants are so fond of the helpless pupæ that the Colaspis never occurs on the roots where they abound. The evil effects of its work are more apparent on young and newly set plants than on older ones, and the only way to prevent the ravages of the worm, which we yet know of, is to so protect newly set plants that the beetles will not get access to them. I have had no opportunity to make experiments, but it may turn out that some application to the ground or to the plant, such as ashes, soot, lime, or salt, will ward off the perfect beetle, and I shall be glad to hear reports from those who are troubled with the pest. The same remedies used in killing the Colorado Potato-beetle would also kill this species.

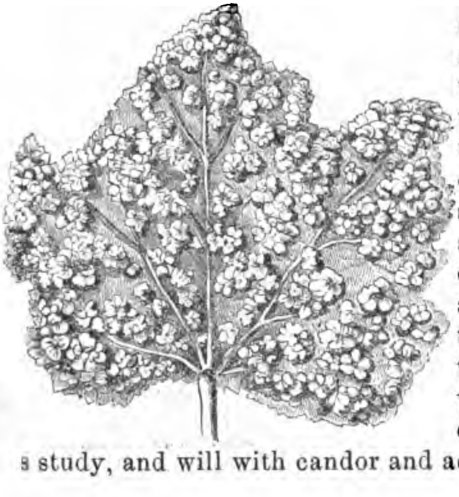
COLASPIS FLAVIDA, Say—*Larva*, (Fig. 38)—Color dingy yellowish; uniformly covered with sparse stiff yellowish hairs. Having the general appearance of a Lamellicorn larva. Slightly arched but capable of stretching out tolerably straight. Narrowest in middle of body, the thoracic and anal joints being slightly swollen. The joints with about three dorsal wrinkles to each. Head honey-yellow, rounded, flattened in front; epistoma and labrum of same color; jaws darker. Legs pale, setous, and terminating in a brown claw. Spiracles scarcely perceptible, the first sub-ventral between joints 1 and 2, the others placed on a lateral series of swellings commencing with joint 4. Joints 4-11 inclusive, each with a pair of soft ventral leg-like appendages, ending in two or more stiff hairs. Anal joint somewhat horny below (Fig. 38, *b*) but with no trace of prolegs. Length 0.25—0.30 inch. Described from two rather poor alcoholic specimens.

THE GRAPE-LEAF GALL-LOUSE—*Phylloxera vitifoliæ*, Fitch.

(Homoptera, Aphidæ.)

Here we have an insect, the life-history of which is as interesting to the entomologist as its devastations are alarming to the grape-grower. I have given it considerable attention the past summer, and though it is a difficult task to present definite and satisfactory information from the multitude of facts obtained, yet I shall endeavor to give a comprehensive account of this little louse, so far as my present knowledge of it will permit. In doing so I am made painfully aware that there is much room left for further observations, and he who will patiently and persistently devote his time for a few years to s study, and will with candor and accuracy give to the world the re-

[Fig. 39.]



sults, will doubtless be rewarded by new and important discoveries, and will render valuable service to the cause of science and of economic entomology.

The first reference to this insect was briefly made by Dr. Fitch, of New York, in the year 1856,[**] and he subsequently described it in a very insufficient manner, under the name of *Pemphigus vitifoliæ*;[*] but though the specific name must be retained, the insect was wrongly referred to the genus *Pemphigus*, as we shall presently see. Ten years afterwards this louse was again referred to by myself in the *Prairie Farmer* for August 3, 1866, and during the fall of the same year articles were written upon it by Dr. Shimer,[†] and by my late associate, Mr. Walsh[‡]—the former claiming that it was a true Plant-louse (*Aphis* family), and the latter that it was a Bark-louse (*Coccus* family). In this Dr. Shimer was evidently right, and Mr. Walsh wrong. In January, 1867, Dr. Shimer proposed for this insect a new family (DACTYLOSPHÆRIDÆ),[§] which, in my opinion, cannot stand.

But not to weary the general reader with purely scientific questions, I shall give the reasons for my opinion on this point, together with some other details, in smaller type at the close.

This louse was subsequently treated of by Mr. Walsh in his report as Acting State Entomologist of Illinois (pp. 21-24), where he still felt inclined to place it with the Bark-lice, though I have good reason to believe that he afterwards changed his mind. During all this time a serious disease of the roots of the Grape-vine began to attract attention in the south of France, and it finally caused such alarm that the Minister of Agriculture and Commerce in France offered a prize of 20,000 francs for the discovery of an efficacious and practical remedy.

A special commission was also appointed to draw up a programme of conditions, examine memoirs submitted to it, settle the experiments to be made, collect evidence from local commissions, and if they saw reason for so doing, to award the prize offered by government. The commission consisted of M. Dumas, M. Milne Edwards and M. Duchartre, of the Paris Academy of Sciences; M. Gervais, M. Planchon, M. Henri Mares and M. Louis Vialla, of Montpellier; the Comte de Vergue, of Gironde; M. Bedel, of Vaucluse, and three members of the Ministry of Agriculture.

The disease is known as *pourridie*, or rotting. It is in the form of little cankerous spots, which cut off the supply of nourishment and cause the roots to rot, and these spots were ascertained by MM. Planchon and Lichtenstein, of Montpellier, to be caused by a louse (*Phylloxera vastatrix*, Planchon,) which bears a close resemblance to our gall-insect. This is not all, for a leaf-gall absolutely identical with ours also occurs there, and the identity of the gall-inhabiting with the root-inhabiting insect was demonstrated by "J. O. W.," in the *Gardener's Chronicle*, of England, for January 30, 1869, and M. J. Lichtenstein even contended that their European species was identical with ours, and imported from this country, in which opinion he was supported by A. Combe-Dalmas.*

[**] N. Y. Rep. I, p. 158.

[*] Rep. 3, § 117.

[†] *Prairie Farmer*, Nov. 3 and Dec. 8, 1866.

[‡] *Pract. Ent.*, Vol. I, p. 111; Vol. II, p. 19; and Proc. Ent. Soc., Phil., VI, pp. 283-4, notes.

[§] Proc. Acad. Nat. Sci., Phil., Jan. 1867.

Of course these views expressed in Europe gave increased interest to our own gall-louse, and I determined to make every effort to decide the question of identity, together with some other questions which presented themselves. To this end I opened correspondence with M. V. Signoret and M. J. Lichtenstein, who were making experiments in France while I was doing the same here. But the blighting effects of the war have not only entailed untold misery and woe to millions in France, but have either paralyzed or effectually balked scientific investigation within her borders, so that at last accounts M. Lichtenstein was in Spain, and M. Signoret shut up in Paris.† I was, however, fortunate enough to receive from the latter gentleman, a few days previous to the investment of Paris, a letter stating that upon examination of specimens of our gall-lice, which I had expressed to him, he was convinced of their identity with the European species. This was indeed satisfactory, and coupled with the fact that I have discovered that our gall-insect likewise attacks the roots of our vines in precisely the same manner as does the European species, and that the winged specimens found in this country by Dr. Shimer agree in having the characteristic dusky band around the middle of the thorax described in the winged female of Europe, it leaves no doubt in my mind that the insects of the two continents are really identical.

As already stated, the war put a stop to investigations in France, and we do not know that any effectual remedy was discovered, or that the premium was disposed of. Carbolic acid, and two other substances, namely, sulphuret of lime dissolved in water, and an empyreumatical oil, known among veterinary surgeons by the name of "oil of cade," dissolved in water, were found to be the best specifics; but neither of them have been tried on a sufficiently extensive scale, and I have little faith in any medicinal remedy.

The two parties who have written most upon the disease, namely, Mr. Signoret and M. Lichtenstein, took entirely opposite grounds as to its cause. The former claimed that it had a botanical rather than an entomological cause, that it was principally due to drouth, bad culture and poor soil, and that the *Phylloxera* was therefore incidental; and acting upon this view, suggested that water, with manure and good cultivation, would do away with it; while the latter maintained that the *Phylloxera* was the sole cause of the trouble. There are, doubtless, certain conditions of soil which will prove favorable to the increase of the louse, and it may also be influenced by the seasons and by good or poor cultivation; but that this insect should be found only on such roots as are already diseased is highly improbable, and there can be no reasonable doubt that M. Lichtenstein is right in attributing the disease directly to the *Phylloxera*. The appearance of mites is the almost inevitable consequence of diseased and rotting vegetation, but Plant-lice cannot live on such vegetation, and invariably leave it as soon as they have, by their punctures, reduced the healthy tissues to such a state. Moreover, the history of our louse, which I shall now proceed to give, corroborates M. Lichtenstein's views.

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* *Insectologie Agricole,* 1869, p. 189.

† Since the above was written, I have heard from M. Signoret through M. Lichtenstein. Nothing daunted by the siege, the former carried on his studies of this little louse, and wrote by balloon, that though he himself was reduced to cats, dogs and horse-flesh, the *Phylloxera*, which he had in boxes, kept well and in good health. No doubt our enthusiastic friend finds much solace in thus pursuing knowledge under difficulties.

In Missouri this insect has proved very injurious to the Clinton vine for several years past—at least as far back as 1864, when the foliage of the Clinton was reported, in the proceedings of our State Horticultural Society, as "very bad"—and Mr. Geo. Husmann informed me that in 1869, it actually defoliated three-fourths of an acre of Clintons and Taylors on bottom land at Bluffton, though it did not appear to do much injury on the hills. It was quite bad around Kirkwood the present year, and, judging from reports, of correspondents and from my own observations, it was more than usually abundant in most of the Eastern States.

In this latitude the first galls are noticed by about the middle of May, and by the middle of June they begin to be quite common. It occurs most abundantly on the Clinton and Taylor, but is also found on the wild Frost Grape(*V. cordifolia*), and such other cultivated varieties of it as Golden Clinton and Huntington; also on the Delaaware, and early in the year I even found a few large galls on the Concord. According to Dr. Morse it also occurs on the Iona, which is a variety of the Northern Fox Grape (*V. labrusca*). The galls vary somewhat in appearance, according to the vine upon which they occur, those I have noticed on the wild Frost Grape being more hirsute than those on the cultivated Clinton, and these again rougher than on the Taylor.

The few individuals which start the race early in the year station themselves upon the upper side of the leaves, and by constant suction and irritation soon cause the leaf to swell irregularly on the opposite side, while the upper part of the leaf gradually becomes fuzzy and closes, so that the louse at last sinks from view, and is snugly settled in her gall. Here she commences depositing, her bulk increasing during pregnancy. Eventually she grows to be very plump and swollen, acquires a deep yellow or orange tint, and crowds the space within the gall with her small yellow eggs, numbering from fifty to four or five hundred, according to the size of the gall. The young lice are pale yellow, and appear as at Figure 40, *d*, *e*. As soon as they are hatched they escape from the gall through the orifice on the upper surface of the leaf, which was never entirely closed; and, taking up their abode on the young and tender leaves, in their turn form galls. The mother-louse, after completing her deposit, dies, and the gall which she occupied dries up. There are several generations during the year, and this process goes on as long as the vines put forth fresh leaves. As the galls multiply and the growth of the vine becomes less vigorous, the young lice sometimes so completely cover the upper surface of the newly expanded leaves as not to leave room for them all to form galls. In this event the leaf soon perishes, and the lice perish with it. When two or more lice are stationed closely together they often form but one gall, which accounts for the presence of the several females that are sometimes observed in a single gall. Those leaves which have been badly attacked turn brown or black, and sooner or later fall to the ground, so that the vine may become entirely denuded.

By August the insects generally become so prodigiously multiplied that they often settle on the tendrils, leaf-stalks, and tender branches, where they form excrescences and gall-like growths, differing only from those on the leaves in such manner as one would naturally expect from the difference in the plant tissues. By this time the many natural enemies of the lice begin to play sad havoc with them; and after the vine has finished its growth, the young lice, finding no more succulent and suitable leaves, begin to wander and to seek the roots, so that by the end of September the galls are deserted, and those few remaining on the vines generally become mildewy, and finally turn brown and dry up. Upon the roots the lice attach themselves singly, or in little groups, and cause by their punctures little swellings and knots, which eventually become rotten. Where vines have been badly affected with the gall, it is difficult to find a perfectly healthy fibrous root. Strange enough, these lice not only change their residence as winter approaches, from the leaf above ground to the root below ground, just like the Moor, who, having passed the summer on his roof, gets into his house in the winter; but, Proteus-like, they change their appearance in shedding their skins, and at the present writing (Nov. 6th) have all become tubercled, as represented at Figure 40, *g*.

No doubt the insect passes the winter on the roots in this tubercled state, but whether in the spring these tubercled individuals produce winged males and females, which rise in the air, pair, and by depositing eggs give birth to the apterous females which found the gall-producing colonies; or whether, as spring opens, they lay eggs on the roots, and the young hatching from these eggs crawl up on to the leaves and found those gall-producing colonies, are questions yet to be settled in the life-history of our Grape leaf-louse. The former hypothesis is, however, by far the most probable, for analogy would lead us to infer that winged males and females must be developed at some time during its annual course, and winged males are so rare in the galls that I have never been able to find them, though I have opened thousands upon thousands of the galls during the summer and fall months. Dr. Shimer, indeed, is the only fortunate individual who has found the winged insect in the galls, and, as he himself tells us, he only succeeded in finding four specimens in the fall of the year, after cutting open ten thousand galls; and he has really given us no proof that his winged specimens were really males, and not females. Let us hope, however, that by pointing out the gaps in the biological history of this insect, attention will be drawn to them, so that they may be the more readily filled.

These discoveries lead us to some most important practical considerations. It now becomes evident that this insect can be transported from one place to another on the roots, either upon transplanted vines or in earth containing fibrous roots. Doubtless it was by some such mode as this that the insect was introduced into France from this country. It may be in this manner likewise that it has in part spread from one portion of our country to another, though as it is found indigenously on the wild Frost Grape, the greater probabilities are that it exists wherever this wild grape is found, and has gradually spread from it on to the cultivated varieties. These probabilities are strengthened by the fact that new grape wood is always rooted in the spring, when the lice, according to my views, are leaving the roots. But the important fact remains, that the insect winters on the roots, and that to exterminate it from a vineyard we have but to root up and destroy, late in the fall, such vines as were affected with the galls. From the poor success that has attended the experiments made abroad to destroy the lice on the roots, and from the fact that it is so difficult to reach them, I have little hope that any other remedy will be found than that of extermination by the means indicated, or by plucking and destroying the gall-infested leaves as fast as they appear in the spring.

Another very important practical lesson may be derived from the facts here mentioned, namely, that no variety of the Frost Grape (*V. cordifolia*) should be cultivated and encouraged where those of the Fox Grape (*V. labrusca*) or of the Summer Grape (*V. æstivalis*) are known to be as good. Some of our best grape-growers, especially in the Mississippi Valley, already discard the Clinton and its nearest relatives as worthless, and, considering its liability to this disease, we heartily commend their conduct.

At the 15th annual meeting of the Illinois State Horticultural Society, at Galesburg, the Clinton was highly recommended by Mr. D. B. Wier, of Lacon, Ills., principally for its vinous and medicinal qualities; but in this recommendation he did not meet with much support except from Dr. Hull the State Horticulturist, who also, in the course of his remarks sustained Mr. Wier in his recommendation of the Clinton, though in our own State Horticultural Report for 1864

(p. 66.) he is reported as being much inclined to discard it, his objection being that it is "troubled by the apple-worm"—by which is doubtless intended, the Grape-berry Moth.

There is some difference of opinion among botanists and experienced grape-growers as to the number of indigenous species of the Grape-vine, and as to the true character of some of the cultivated varieties. Some botanists are inclined to the opinion that we have but two, or even but one, species; and certain it is that the fertile character of the hybrids would lead to such an opinion, if infertility of hybrids is to be taken as a test of specific character. But it is more generally accepted that we have four distinct species (*V. labrusca*, *æstivalis*, *cordifolia* and *vulpina*) and this view is held by most western men,* and is perhaps warranted when we reflect that the very term species is but arbitrary, and that fertility of hybrids is not valued so much as an indication of specific identity among plants and some of the lower animals, as it is among more highly organized beings.

As already stated, our Grape leaf-louse is now principally confined to varieties of the Frost Grape;† but as it has been found in limited numbers on Iona and Concord, which are considered as varieties of the Northern Fox, and on the Delaware, which is considered either as a Summer Grape or as a hybrid between the Summer and the Northern Fox, I fear it may yet spread and become injurious to these species. Morever, now that we know that our insect is identical with that of Europe, there is also great danger that it will attack all hybrids with the European *Vinifera*, some of which, as the "Goethe," now promise well. Thus the reasons for discarding the Clinton and other Frost grapes become multiplied, for their cultivation may endanger the whole grape-growing interest of the country. On entomological grounds, I say emphatically to western men, do not plant any more Clintons, and get rid of those you now have as quickly as possible.

At the recent meeting of our State Horticultural Society at St. Joseph, some little discussion followed a paper which I read on this gall-louse and I was pleased to find that Dr. C. W. Spaulding, well known as a successful and experienced grape-grower, together with many other members, fully concurred in the advice here given. He had examined many of his vines, after his attention had been called to the matter, and found that the lice were found principally on the roots of old vines, and not on those of young ones. At this meeting it was almost unanimously agreed that the Clinton was comparatively worthless and should be done away with, but a few of the more conservative members, hesitated about discarding it for fear that such action would bring about the very result which it was intended to avoid, *i e.*, the spread of the insect on to other and more valuable varieties. In other words they feared that by taking away the Clinton, the lice which now prefer this variety and flourish and multiply upon it, would be forced to attack other varieties. They looked upon the Clinton, as a protector to the better kinds, by drawing the lice away from them, arguing, to parady the words of Shakespeare, that

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* See Husmann, "Grapes and Wine"; Flagg, *Hearth and Home*, Sept. 3, 1870; Spaulding, Lecture delivered at the Illinois State Fair, 1870.

† Though Gray considers the Clinton a variety of the *Æstivalis*, it is more generally considered as belonging to *Cordifolia*, which its great liability to the gall-louse would indicate.

"'Tis better far, to bear those ills we have
Than fly to others that we know not of."

Now while I admire the cautious spirit manifested in such an argument and admit that it seems plausible, I cannot believe there is any logic in it. The argument presupposes that the louse, as a species, can suddenly change its habits and tastes when forced to do so; but to my mind, a new habit is not generally acquired in a species by the simultaneous change of all the individuals composing it, but by some aberrant individual first taking on the new habit, and transmitting that habit to its descendants until a new race is in time produced. A single Clinton vine may stand in the midst of a vineyard of Concords for years, and, as we know to be the case, may be badly infested with this louse without its spreading on to the surrounding Concords. The lice may, and perhaps do, year after year spread on to and settle on the comparatively tougher leaves of such Concords, but year after year they perish from incapacity to sustain themselves. Some day, however, one or more aberrant individuals, may, by some slight constitutional difference from the normal type, be enabled to sustain themselves on the Concord leaves, and, by the laws of inheritance, transmit their characteristics to their descendants until, by the survival of those from each generation best fitted to flourish on these leaves, a new Concord-feeding race will be produced. Therefore, as already stated, I believe that there is danger of this louse spreading on to other varieties, and especially on to such as are more closely allied to the *Cordifolia*, or, to use a common but inexact expression, that have *Cordifolia* "blood" in them. But it must not be forgotten that we are here only supposing, from analogy, what *may* occur, because we know not positively that it *will* occur, and it is very obvious that even if there is this danger the chances of such an occurrence will be far greater as long as the Clinton is allowed to grow in the vineyard, than when it is uprooted and banished; and so far as all experience goes, we can safely conclude that to destroy all those vines in a vineyard that are infested with this louse, is to banish it from such a vineyard so that it will in future confine its attacks to the wild frost, as it did in the beginning.

The Apple-maggot (*Trypeta pomonella*, Walsh), as Mr. Walsh has demonstrated,* is an indigenous American insect and breeds in our ild haws, occurring abundantly in the West, as well as in the East. Of te years it has acquired an appetite for the cultivated apples in me of the Eastern States, where it already does much damage to the ›ple crop. Yet, strange to say, it has not yet, and may never attack e cultivated apples in the West, and there is more danger that in ocess of time the more civilized Apple-maggots of the East will read to the West, than that our haw-feeding maggots which are now nong us, will acquire that habit, as a race of them once did in the ıst. Now no one will argue that if the Apple-maggots of the East ere to be exterminated, the maggots in the wild haws would any the oner attack our cultivated apples; and in like manner the extermination of the lice on our Clinton vines will not cause those on the ild Frost to any the sooner attack our Concords.

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*Report as Acting State Entomologist of Illinois, pp. 29-30.

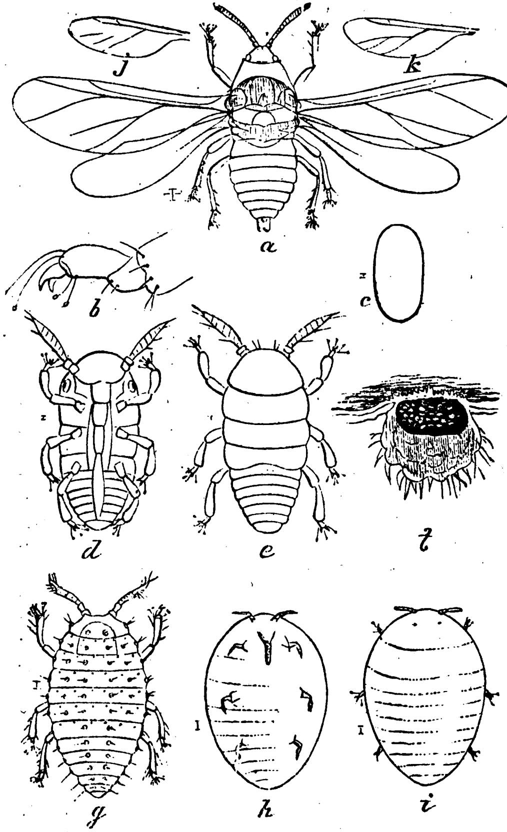
To give another illustration:—Our White pines have for years ›en greatly injured by the Pine-leaf Scale (*Aspidiotus* [*Mytilaspis*] *nifoliæ*, Fitch) and I know that this same scale occurs to a slight :tent on several other species of the genus, and have good reason believe that it (or a race of it) is becoming more and more numerıs on the Scotch pine around St. Louis. Yet to get rid of this scale would not hesitate to destroy such White pines as were infested with for fear that by such a procedure I should drive the scales on to ıy other pines; because I believe that the scales on the Scotch pine r instance, multiply among themselves rather than by the annual ansportation of individuals from the White pine, and because the :perience of the past teaches that the latter is the only pine which ;s really suffered injury from this scale.

Other similar illustrations might be given, but I close by reiterating the opinion that there is nothing in the past history of the Grapeaf Gall-louse to warrant the belief that by destroying the Clinton e shall force it on to those more valuable varieties which it has not therto attacked, and that whenever, as is admitted to be the case in e central portion of our State, the Clinton can be replaced by other ıd better varieties, it will be most wise and judicious to discard it. ıave no idea that we shall ever exterminate this louse from our neyards, because we can never obtain concert of action all over the ›untry, and because it will flourish in a measure on other cultivated ırieties of the *Cordifolia* group. But let each individual act for mself, and I feel satisfied that so far as he follows the advice here ven, just so far will he be benefited.

There are several cannibal and parasitic insects which attack is Gall-louse, but for lack of time to make the proper illustrations, I all have to leave their consideration to a future Report.

Figure 39, at the head of this article, represents a leaf covered with ılls. Figure 40, (*a*) represents the winged female; (*b*) her foot or rsus—after Signoret; (*c*) an enlarged egg; (*d*) the newly hatched ıll-inhabiting type, ventral view; (*e*) same, dorsal view; (*f*)

[Fig. 40.]



a section of a gall; (*g*) the tubercled root-inhabiting form; (*h*) the mother gall-louse at the heighth of her fertility, ventral view; (*i*) same, dorsal view—all from nature; (*j* and *k*) differently veined wings of the Oak *Phylloxera* of Europe. All these figures are greatly enlarged, and the natural size is approximately shown by hair-lines.

The following discussion of this insect's proper place in our classification, and of its characters, may be passed over by the practical reader, as it is intended for those only who take an interest in such questions. I append it with but very slight alteration, as I wrote it for the last number of the second volume of the *American Entomologist:*

It will be remembered that in what was said about this insect on page 248 of our first volume we criticized the founding of the Family *Dactylosphæridæ* by Dr. Shimer. In an essay read before the Illinois State Horticultural Society, at Ottawa, last winter, Dr. Shimer took exception to our remarks, and called upon us to give a reason for the faith that is in us. Not considering a horticultural meeting the proper place to enter into the discussion of purely entomological questions, we declined to waste the precious time of the members, but intimated that we should be glad to answer the Doctor whenever a favorable occasion presented. The opportunity did not offer till now, as the Transactions of the Society, containing the essay in question, have but recently been published, but as we ourselves wrote the strictures, we will briefly give our reasons for so doing. In order to lay the question clearly before those interested, it will be necessary to quote that portion of our former article which so exercised friend Shimer. It runs as follows:

The louse which forms the gall was first described as *Pemphigus vitifoliæ* by Dr. Fitch, of New York, though it does not belong to that genus, Dr. Shimer, of Mt. Carroll, made some interesting observations on the habits of this insect, and made it the type of a new family (*Dactylosphæridæ*) and of a new genus (*Dactylosphæra.*) The distinguishing features of this supposed family are certain appendages attached to the legs which Dr. Shimer calls *digituli*, though the characters of the wings point unmistakably to the genus *Phylloxera* of the true Plant-lice. We shall not now discuss the validity or propriety of this new family, as we intend to give a more complete account of this louse in our future articles on Grape insects; but we will say here that Dr. Shimer is unfortunate in grinding out new genera and new families, for he has proposed a new family and genus (*Lepidosaphes*) for the common Apple-tree Bark-louse (*Aspidiotus*) [*Mytilaspis*] *conchiformis*, Gmél.) based upon similar appendages, which he found on its legs; whereas, if he had been better posted he would have known that these appendages are characteristic of almost all Bark-lice.

And here is Dr. Shimer's appeal:

Here they would like to make the public belive that these appendages, *digituli*, are the characters out of which I have proposed two families in Entomology; whereas, the leading character upon which I propose my family *Dactylosphæridæ*, is two claws on a one-jointed tarsus, and the leading characters in *Lepidosaphidæ* are a tarsus without a claw, and a *scale-making*, not a scale-like insect. The *digituli* from their globe-ended extremities I consider of some importance, but by no means of primary weight in the first named family, and in the second family I give them no more than secondary importance. What reasons the junior editor, for he alone now becomes responsible, can assign for so gross a misrepresentation I am not able to anticipate. He certainly, however, will be able to give some reason for the faith within him. * * * * * * I have not the slightest personal feeling in the matter, and I hope that my much respected friend, Mr. Riley, State Entomologist of Missouri, will be free to defend the position he has taken against me.

Now, we believe Dr. Shimer is sincere in stating that he has no personal feeling in the matter, else we should not even notice his request. We hope, therefore, that he will believe us when we state that in the few words we are about to pen we are governed by no personal considerations whatever, but by a love of truth for truth's sake. As Dr. Shimer becomes more familiar (and we hope he will so become) with the minute and interesting insects to which he has more especially turned his attention, he will no doubt regret that he ever proposed those two families without longer pondering and considering.

Regarding the Bark-louse, we will dismiss the subject in a few words, as it is foreign to the topic under consideration. Dr. Shimer, it is true, deserves severe handling for the cool and skeptical manner in which he refers to the work of all preceding entomologists, and the laughable way in which he arrogates to himself the power of correct observation;** but at present we will simply accede to his request, as follows:

We confess that in stating that Dr. Shimer had based his new family, LEPIDOSAPHIDÆ, upon the occurrence of *digituli*, we should have qualified our language by inserting "partly" before "upon," since the characters as given by him are, *"Four digituli terminated by pulvilli or arolia, and no claw, and the female living beneath a scale or shell-like habitation of her own constructing."** But we insist that the proposition of a family on such grounds was not only unfortunate, but unwarranted, for the following reasons: First, the so-called *digituli* are not even of generic, much less of family value, as they are nothing but modified hairs, and occur in a more or less perfect form in all young *Coccidæ* and *Aphidæ* which we have examined, and are acknowledged by the best authorities to be common to both these families. Secondly, the insect in question really has a more or less perfect claw, as we have abundantly demonstrated the present year. Thirdly, the assumption† that the scale in all COCCIDÆ should be part and parcel of the insect itself, is a purely gratuitous one, since there are many other species which live separate from their scales, and since the genus *Aspidiotus* was especially erected by Bouché for those species which thus live *under* and seperate from them. Consequently there remains not a single character mentioned by our author but what is well known to belong to the COCCIDÆ, and there is not even the slightest excuse imaginable for seperating it from Costa's genus *Diaspis*, to which it is now correctly referred by Signoret—our highest authority on this family.

Now let us return to our Grape-leaf louse. We have no trouble in proving by Dr. Shimer's own words that we were perfectly justified in saying that the "*digituli*" were the "*distinguishing* features" of his supposed family *Dactylosphæridæ*. The very meaning of the word (globe-fingered) given to the family indicates such to have been the case, and he himself expressly says:‡ "The wing neuration of *Dactylosphæra* is synonymous with that of *Phylloxera*; it is, therefore, upon the other characters that I found this genus." Now what are the other characters? Turning to the family characters given, we find: "Wings four, carried flat on the back in repose. Antennæ few-jointed. Tarsi composed of one joint terminated by two claws, and from two to six *digituli*. Honey tubes none; otherwise resembling *Aphidæ*."§ The only other character given which is not Aphidian is the one-jointed tarsus, which, as we shall presently show, cannot, strictly speaking, be considered a character of our Gall-louse, and which, even if it were, would scarcely warrant the making of a new family. Every other character, including the *"digituli,"* is common to dozens of plant-lice, and the neuration of the insect's wing‖ places it beyond any doubt in the genus *Pyllox-*

**Trans. Am. Ent. Soc. I, pp. 371-2.

* Trans. Am. Ent. Soc., I, p. 372.

† Ibid, p. 371.

‡ *Characters for a supposed new family*, p. 5, note; from the Proc. Acad. Nat. Sci., Phil., Jan., 1867.

§ Ibid, p. 1.

‖ The neuration of the wing differs slightly from the typical European *Phylloxera quercus*, in the two discoidal veins of the front wing uniting in a fork instead of being perfectly separated. On this account Mr. Walsh proposed for our insect, and for certain other species found in hickory galls, which have the same neuration, the generic name of *Xerophylla*. But it seems to us that the polymorphism of APHIDÆ has not yet been sufficiently investigated to allow of making even different species, much less different genera, upon a forked or unforked nervure, for there is frequently much greater difference in specimens coming from the same parents; and, as we are informed by M. Lichtenstein, the European *Phylloxera* of the Oak actually presents both kinds of neuration;

era, which has long been ready to receive it, and which, with the genera *Vacuna* and *Chermes*, form the sixth Tribe, *Chermesinæ*, of the APHIDÆ, according to Passerini's latest revision of this family.

We can commend the carefulness with which Dr. Shimer made the interesting observations which he has given us on this insect, but no man should undertake to found new families without first informing himself more thoroughly of what has already been done by others.

It was by no very easy means that we arrived at the conclusion that our Gall-louse is identical with the European species, but now that the fact seems sufficiently proved, Planchon's specific name *vastatrix* will have to give way to Fitch's *vitifoliæ*,* or at the most be retained as a variety.

At first there seemed to be many reasons for considering the two insects distinct. First, the European root-louse was exceedingly destructive, and their gall-louse of only exceptional occurrence; while our gall-louse was very common and destructive, and no root-lice were known to exist here at all. Secondly, the insect found in the galls was smooth, while that on the roots was distinctly ornamented with piliferous tubercles, and the two were sufficiently unlike to cause M. Lichtenstein, who believed in their identity, to propose the term gall-inhabiting (*gallicole*) for the one race, and root-inhabiting (*radiciole*) for the other. Thirdly, our insect was described as having a one-jointed tarsus, whereas M. Signoret described and figured the tarsus of the winged root-inhabiting form as two-jointed. Fourthly, there seemed to be a difference even in the form of our gall-inhabiting louse and theirs, as ours appeared much more obese and globular than theirs, as represented in their figures. All these apparent differences were rather calculated to give rise to doubts as to the identity of the two insects; but by careful observation and persistency we have been enabled to dispel them all.

First, we might naturally expect—and those who believe in the Darwinian hypothesis certainly would—that, presuming our insect to have been imported into Europe, it would undergo some modification in its habits, not only because of change of climate, but because of its having to live on another species of the Grape-vine—all the European species belongs to *Vitis vinifera*. Hence its normal habits there, of feeding on the roots, may have been gradually acquired. We believe a parallel case presents itself in our Apple Root-louse (*Eriosoma pyri*, Fitch) and the Wooly Aphis, or so-called "American Blight" (*Eriosoma lanigera*, Hausm). It is conceded on almost all sides† that the last insect was imported into Europe from this country, and there is now every reason to believe that the two insects are identical, or that at furthest they can only be considered as varieties of one species. Yet while in this country our root-louse is very injurious in the West, and only exceptionally found on the limbs above ground (though more often so found in the Eastern States); all authors that we are acquainted with have spoken of it as occurring solely on the limbs in Europe; though M. Lichtenstein informs us that he has found it on the roots also, and that in those cases it caused just such swellings of the roots as our root-louse does here. We know in St. Louis of an old apple-tree, standing in a yard where the ground is trodden hard, the limbs of which have been for the past three years more or less affected with this insect, though none can be found on the roots. But where the ground is more porous, and not so closely pressed to the roots, it seldom occurs on the branches, but often on the roots, even in the immediate neighborhood. Upon the closest examination we cannot find the slightest difference between the root and branch-inhabiting lice,

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there being red specimens with unforked nerves (Fig 40, *j*) and yellow specimens with forked nerves (Fig. 40, *k*). I have in my possession the very drawing made by Mr. Cresson from Dr. Shimer's specimen of *vitifoliæ*, which Mr. Walsh refers to in his Report, and which led Mr. W. erroneously to place our louse with the Coccids. The drawing is rough, evidently imperfect, and well calculated to mislead, for the discoidal nerve of the front wing is represented more as a fold, the forks are omitted, and the costa of hind wing is represented perfectly straight. The drawing is also accompanied by Mr. Cresson's statement that he could not give any decided opinion as to the neuration, as the wings on the specimen were not spread out.

* M. J. Lichtenstein has objected to Fitch's specific name "*vitifoliæ*" on the score of its being ungrammatical, and has substituted the term "*vitis-folii*" in his published reports. Now Dr. Fitch has given the termination "*foliæ*" to a number of his specific names, and though "*folii*" would of course be more grammatically correct, one would suppose the Doctor had some reason for his conduct. At all events I believe it is perfectly proper to drop the middle *s* in compounding the two words, and certain it is that Fitch's term has been adopted by all subsequent writers in speaking of the insect. Irregularities in entomological nomenclature seem to be allowable, or at least are very frequently and purposely perpetrated for the sake of euphony. "Whatever is, is right," is as true in language as it is in religion, and if we alter *vitifoliæ* we must alter a thousand other entomological names that are not, strictly speaking, grammatically correct. It is quite proper to correct a faulty name, but after showing that it is faulty it seems best, to prevent endless confusion, to adopt the faulty name, and thus make its author shoulder the blame, until he himself corrects it.

† M. Eudes-Deslongchamps and M. Blot are the only authors, according to Amyot and Serville, who believe it is indigenous to Europe.

and no doubt their habitat is governed somewhat by the character of the soil, though in this country their normal habit is to attack the roots, and to appear above ground only occasionly in the fall.

Secondly, we have proved, by transferring on to roots the young grape-lice hatched from galls, and by successfully feeding them on those roots, that our smooth gall-inhabiting type gives birth to the tubercled root-inhabiting type; and we have discovered that our gall insects take to the roots in the fall, on which they cause the same cankerous spots and swellings as does the *vastatrix* of Europe, and on which they evidently hibernate just as *vastatrix* is known to do.

Thirdly, although in the gall-inhabiting type, in both countries, the tarsus seems to be one-jointed, yet in the root inhabiting type it is really two-jointed; for though the basal joint is small, and not visible from above, it is plainly visible from the side or from below (See Fig. 40, *b*). We have here what certain speculative entomologists would consider an excellent illustration of the inferiority of Coccidæ compared with the Aphidæ, namely, a true Aphidian, exhibiting in its larval and agamic stage the one-jointed tarsus of a Coccid, and only showing the two-jointed tarsus of its family in the more perfected tubercled form, and in the winged state. And this Coccid-affinity in the less perfect gall-producing state is sometimes carried still farther, as we have often been unable to discern but a single claw to the tarsi of some of the young gall-inhabiting individuals.

Fourthly, the fact that M. Signoret, who alone has compared actual specimens from both countries, decides them to be identical, would sufficiently indicate that the difference noticeable in the form depends on the observer, and on the stage of growth at which observations are made.

It was the one-jointed tarsus in the gall insect which no doubt in part led Dr. Shimer to propose a new family for it, and it was this character—coupled with the facts that it is oviparous, that it does not secrete any sugary or flocculent substance (as do most gall-inhabiting Plant-lice), and that the young forsake the gall and scatter over the leaves as soon as hatched—which led Mr. Walsh to consider it as an anomalous and aberrant Coccid. The genus *Phylloxera* seems also, according to Westwood, to have been doubtingly introduced into this family by Curtis in his Guide. We have already shown that, in the root-inhabiting form, the two joints of the tarsus are plainly to be seen; and Dr. Shimer himself admits[*] that, in the winged insect which he found in galls, he noticed a constriction on the under side of the tarsus, though he is unwilling to allow that it was a joint, because there was no motion. But even if the 2-jointed character of the more perfect louse were not demonstrated, all the other characters are so unmistakably Aphidian that there is, we think, no warrant in making a new family. In such degraded insects, where the antennal joints are so variable, we might naturally expect to find variation in the joints of the legs. The more familiar we become with the biological secrets of Nature, the more do we find, not only species but genera, and even families, approaching each other through modifications found in individuals; and these aberrant gall-lice only help to give us a better idea of the close connection between the *Coccidæ* and *Aphidæ*. Our *Phylloxera* brings the two families close together, by its affinities on the one side with *Chermes* of Linnæus, which, though looked upon as a Coccid by Ratzeburg, is generally considered an Aphidian, and on the other with the Coccidan genus *Dactylopius* which contains Linnæus's *Coccus adonidum*. The oviparous nature of these gall-lice will also have less significance when we reflect that there is a sort of gradation in this process, and that many Plant-lice which are considered viviparous or ovoviparous do in reality bring forth their young enveloped in a more or less distinct egg-like film or covering, from which they have to free themselves by a process analogous to that of hatching. This has not only been observed by Curtis, in the case of an *Aphis* found on the turnip,[†] but by Dr. Wm. Manlius Smith, of Manlius, N. Y.,[‡] in the case of *Pemphigus;* but we have, the present year, assured ourselves of the accuracy of Dr. Manlius's observation as to *Pemphigus*, and witnessed the same thing in *Eriosoma*, namely in *E. pyri*, Fitch. In this last case the newly deposited louse (or egg) remains motionless for a considerable time; and the covering, after the young louse has extricated itself from it, may be as distinctly seen attached to the end of its body as the covering or egg-shell of our Grape gall-louse, and was figured by Fitch, who mistook it for the cotton-like matter, which, however, is not secreted till the louse fastens itself and begins to grow.[§] Moreover those Aphidians which are viviparous through the spring and summer months, generally lay eggs in the fall; and though agamous and viviparous multiplication can be prolonged by submitting the lice to a continued artificially warm temperature, there is doubtless a limit to this prolongation; and it may be laid down as a rule that, with most Aphidians, the ♂ element and the production of eggs are, at some time or other, indispensable to the continuance of the species.

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[*] Characters of a Supposed New Family, p. 3.

[†] Farm Insects, p. 65.

[‡] Auctore Walsh, P. E. S. P. VI, p. 282, note.

[§] N. Y. Rep. I, p. 9.

THE COLORADO POTATO BEETLE AGAIN.

THE BEST MEANS OF FIGHTING IT—A WORD TO OUR CANADIAN NEIGHBORS.

To give some idea of the onward march of this destructive insect, and to lay before the reader the experience that has been gained since the publication of my first Report, I transmit the following article from the *American Entomologist* of last September.

Last July, while spending a few days in Ontario, we ascertained that this most destructive insect had just invaded the Dominion at two different points, namely, near Point Edward, at the extreme south of Lake Huron, and opposite Detroit, near Windsor, at the south-western corner of Lake St. Clair. These are precisely the two points at which we should naturally expect to first meet with it on the Canadian border; for all such beetles as fly into either of the lakes from the Michigan side would naturally be drifted to these points. As we know from experience, many insects that are either quite rare, or entirely unknown on the western side of Lake Michigan, are frequently washed up along the Lake shore at Chicago; and these are so often alive and in good condition, and so often in great numbers, that the Lake shore is considered excellent collecting ground by entomologists. In like manner grasshoppers are often washed up on the shores of Salt Lake, in Utah, in such countless numbers that the stench from their decomposing bodies pollutes the atmosphere for miles around. We have not the least doubt, therefore, in view of these facts, that the Colorado Potato Beetle could survive a sufficient length of time to be drifted alive to Point Edward, if driven into Lake Huron anywhere within twenty or thirty miles of that place, or if beaten down anywhere within the same distance while attempting to cross the lake.*

How truly is Mr. Walsh's prophecy being fulfilled, that the northern columns of this great army would spread far more rapidly than the lagging southern columns.†

Now, what will our Canadian brethren do? Will they stand by and listlessly see this pernicious insect spread over their territory like a devouring flame, as it has done over the Western and Central States; or will they make some determined and united effort to prevent such a catastrophe? Of one thing our friends across the border may rest assured—they have not here a sham and braggart Fenian army to deal with, but an army which knows no retreat, and whose

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*The following item which was clipped from the St. Joseph (Mich.) *Herald*, after the above was written, attests the accuracy of the inference :—"Whoever has walked on this shore of Lake Michigan has observed large numbers of the Colorado potato beetle, crawling from the water. Many have doubted the source whence they came. It would seem from the following that they fly, and swim from the western shore of Lake Michigan. Capt. John Boyne of the Lizzie Doak, reports finding his deck and sails infested with potato bugs when half way from Chicago to St. Joseph at night. Not a bug was on deck when the schooner left Chicago."

†*Practical Entomologist*, I, p. 14.

embers, though of small and insignificant stature, will fully make up in number what they lack in size.

When we calculate the immense loss, amounting to millions of dollars, which this insect has cost the Western States during the past nine or ten years—when we contrast the healthful and thrifty aspect of the potato fields in Ontario and in those States to which this potato plague has not yet spread, with the sickly, denuded, or Paris-green-besmeared fields at home—but above all when we reflect that, nothing preventing, it will infest the whole of Ontario within, perhaps, the next two, and at farthest within the next three years—we feel that it is high time to make some effort to prevent its onward march through Ontario, if ever such an effort is to be made. The warnings and instructions given by the Agricultural press, and through our own columns, will avail but little, as they reach the few only. It may be, and doubtless is, true that successful culture, as our country becomes more thickly settled, will be confined to the intelligent and well-informed; yet the fact nevertheless remains, that the masses will do nothing to ward off an evil until they are forced to it from necessity. The plodding, non-reading farmer will take no notice of the few bugs he first sees in his potato field, because they do him no material injury; but when the bugs have increased so as to make it a question of "potatoes or no potatoes" with him, then his energies will be aroused. But alas! his best efforts, at this time, often prove unavailing, and he has to spend days to accomplish that which a few minutes would have accomplished before. We therefore fully expect to see this great army of bugs continue its eastward march without hindrance, unless other preventive measures are taken than those already employed. A standing premium offered by the Minister of Agriculture, Mr. Carding, for a given number of beetles, or for the greatest number collected and killed in one season, or for the cleanest and best field of potatoes, of a given number of acres, within the infested districts along the eastern shores of the lakes mentioned and those of the St. Clair river; might, and undoubtedly would, be the best means of stamping it out, and of keeping it out of the Dominion.*

No doubt that, in suggesting any expenditure of money for such purposes, our Canadian brethren will deem us over-enthusiastic about "small things," and over-anxious for their welfare. Well, be that as it may, we don't forget that there is considerable of Uncle Sam's territory beyond Niagara. It is a mere matter of dollars and cents, and we venture to say that, when once this insect shall have spread over Ontario, a million dollars would be freely spent to accomplish that which will then be almost impossible, and which a very few thousands would effectually accomplish now—namely, its extermination from the Dominion.

An excellent chance is now afforded in Ontario—almost surrounded as it is by lakes—to keep this destructive enemy at bay. In the summer of 1869, reports of this insect's ravages, and of its progress eastward, came thick from Wisconsin and Indiana; but no organized effort was made to check it, and indeed there was very little chance of doing so. It is fast spreading through Ohio; and according to Dr. Trimble of New Jersey, has already reached Pennsylvania. Uncle Sam cannot well prevent its spread around the southern shore of Lake Erie, through Pennsylvania and eastward; but, if it can be effectually resisted between Point Edward and the Detroit river, there will be little difficulty in preventing its crossing at Niagara. A victory would indeed be gained if, by intelligent effort, this grievous pest could be kept out of Upper Canada, while it is devastating the potato fields on all sides in the States; and Minister Carding would add to his well-deserved popularity by making the effort, whether it succeeds or not.

PARIS GREEN A REMEDY.

While on this subject it may be well to say a few words about the use of Paris green. This substance has now become THE remedy for the Colorado Potato Beetle, and it is the best yet discovered. Having thoroughly tested it ourselves, and having seen it extensively used, we can freely say that, when applied judiciously, it is efficient and harmless. If used pure and too abundantly, it will kill the vines as effectually as would the bugs, for it is nothing but arsenite of copper (often called "Scheele's green" by druggists), and contains a varied proportion of arsenious acid, according to its quality—often as much as fifty-nine per cent., according to Brande & Taylor. But when used with six to twelve parts, either of flour, ashes, plaster or slacked lime, it causes no serious injury to the foliage, and just as effectually kills the bugs. The varied success attending its use, as reported through our many agricultural papers, must be attributed to the difference in the quality of the drug.

We hear many fears expressed that this poison may be washed into the soil, absorbed by the rootlets, and thus poison the tubers; but persons who entertain such fears forget that they themselves often apply to the ground, as nourishment for the vines, either animal, vegetable or mineral substances that are nauseous, or even poisonous to us. Animal and vegetable substances, of whatsoever nature, must be essentially changed in character and rendered harmless before they can be converted into healthy tubers, and a mineral poison could only do harm by being taken with the potatoes to the table. That any substance, sprinkled either on the vines or on the ground, would ever accompany to the table a vegetable which develops underground, and which is always well cooked before use, is

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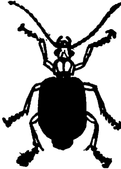
* The Rev. C. J. S. Bethune, in the *Canada Farmer* for October 15th, 1870, also recommended the marking off of a tract of country about ten miles in width, all along the border line between the foot of Lake Huron and the head of Lake Erie, with the exception, possibly, of a portion of the eastern shore of Lake St. Clair, and stopping the culture of the potato throughout that whole tract during the prevalence of the pest in the neighboring State of Michigan.

rendered highly improbable. There can be no danger in the use of sound tubers. But the wise and well-informed cultivator will seldom need to have recourse to Paris green, as he will find it more profitable to use the different preventive measures that have from time to time been recommended in these colums.

The poison may do harm, however, by being carelessly used, and it is most safely applied when attached to the end of a stick several feet long, and should not be used where children are likely to play.

NATURAL CHECKS INCREASING.

[Fig. 41.]



In many parts of the West this insect is being kept in due check by its cannibal and parasitic enemies, which are still increasing. Thus we learn from many sources that in Iowa and Kansas it is not nearly so injurious as it formerly was, while in some parts of Illinois and Missouri it has also become less troublesome. Last year Mr. T. Glover published the fact that the Great Lebia (*Lebia grandis*, Hentz, Fig. 41) was found devouring its larvæ,* and though hitherto considered rare this Lebia has suddely fallen upon it the present year in many parts of Missouri. During a recent trip along the Missouri Bottom we found this cannibal very abundant in some potato fields belonging to Mr. Wm. Coleman, where it was actively engaged in destroying both the eggs and larvæ of the Potato Beetles. The head, thorax and legs of this cannibal are yellowish-brown, in high contrast with its dark-blue wing-covers.

This makes fourteen conspicuous enemies of our Colorado Potato Beetle which we have figured, and a dozen more, mostly of small size and inconspicuous markings, might easily be added to the list. Moreover, chickens have learned to relish the eggs, and have even acquired a taste for the young larvæ. So we need not wonder that the army is being decimated in those States first invaded by it.

BOGUS EXPERIMENTS.

It was recently reported to us that a neighbor had succeeded in driving away all his Potato bugs by strewing Elder branches among the vines. We went to examine the field and found our friend enthusiastic over his discovery; and indeed though the vines were nearly devoured, there were but a few full grown larvæ to be found. But, as he could not tell us what had become of the "slugs," we undertook to show him where they had gone, and after digging a few moments with a trowel, unearthed dozens of them, the majority in the pupa, but a few yet in the larva state. Our neighbor had, in fact, been misled by appearances, for want of better knowledge of his enemy. The larvæ as they acquired their growth suddenly became so destructive, that to save his vines he was obliged to try some means of killing them, and as an experiment he tried the Elder. The larvæ were just ready to disappear of their own accord, and as the great bulk of them did really disappear in two or three days after the application, the apparently logical inference was made that they had been driven away by the smell of the Elder.

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* Dept. of Agr. Rep. 1868, p. 91.

How many of the published remedies that flood the country owe their origin to just such defective proof! The sun-scorching remedy, which consists of knocking the bugs off the vines on to the heated ground between the rows, and which has been so often recommended the present year, partakes a good deal of this character; for it can only be of benefit in a very dry season, and at a time of year when the bugs have done most of their damage. A goodly proportion of the larvæ that are thus knocked off will always manage to burrow into the ground and transform, or to get back upon the vines; and

THE TRUE REMEDY

consists in preventing them from becoming numerous so late in the season. Watch for the beetles in early spring, when the vines are just peeping out of the ground. Ensnare as many of them as you can before they get a chance to pair, by making a few small heaps of potatoes in the field planted : to these the beetles will be attracted for food, and you can easily kill them in the morning. Keep an eagle eye for the eggs which are first deposited. Cultivate well, by frequently stirring the soil. Plant early varieties in preference to late ones because the bugs are always more numerous late in the season than they are during the spring and early summer. Give the preference to the Peach Blow, Early Rose and such other varieties as have been found most exempt from attack,* and surround your fields on the outside by rows of such tender-leaved varieties as the Mercer, Shaker, Russet, Pink-eye and Early Goodrich ; but, above all, isolate your potato field as much as possible, either by using land surrounded with timber, or by planting in the centre of a cornfield. Carry out these suggestions thoroughly and you will not have much use for Paris green and still less for the scorching remedy.

THE CODLING MOTH AGAIN.—*Carpocapsa pomonella*, Linn.

HAY-BANDS VS. RAGS—ALWAYS TWO-BROODED IN MISSOURI.

After a series of experiments, instituted the past summer, I have proved that, after all, the hay-band *around* the trunk of the tree is a more effectual trap for the Apple-worm than the rags placed in the *fork* of the tree. There is no superiority in the rags over the hay-band, unless the former are made to encircle the tree as thoroughly as the latter. Where rags are placed simply in the forks, many of the worms pass down the tree from the outside of the branches. If the rag is tied around the trunk, it will impede almost every worm that crawls down the tree from the fruit which hangs on, or that crawls up the trunk from the fruit which falls; and it then has a decided advantage over the hay-band, because it can either be passed through a roller or scalded, and used again.

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* After experimenting last summer with eighty-one varieties of potatoes, the Superintendent of the garden of the Iowa Agricultural College reports the varieties of the Peach Blow, the Peerless and Chili No. 2, as most exempt from the ravages of this insect, the last named variety not being worked upon at all.

It has been very generally accepted in this country that the Codling Moth is double-brooded, and in all my writings on the subject I have stated it to be so, though no one, so far as I am aware, ever proved such to be the case beyond a doubt. Mr. P. C. Zeller, of Stettin, Prussia, informed me last winter that it is only single-brooded in that part of the world, and Harris gives it as his opinion that it is mostly so in Massachusetts. Now, such may not improbably be the case in northern Prussia, and the more northern of the United States, though I incline to believe otherwise. At all events, this insect is invariably double-brooded in the latitude of St. Louis, and its natural history may be briefly told as follows: The first moths appear, and begin to lay their eggs, soon after the young apples begin to form. The great bulk of the worms which hatch from these eggs leave the fruit from the middle of May to the middle of June. These spin up, and in from two to three weeks produce moths, which pair and in their turn commence, in a few days, to lay eggs again. The worms (second brood) from these eggs leave the fruit, some of them as early as the first of September, others as late as Christmas. In either case they spin their cocoons as soon as they have left the apples, but do not assume the pupa state till towards spring—the moths from the late matured worms appearing almost as early as those from the earlier matured ones. The two broods interlock, so that in July worms of both may be found in the fruit of one and the same tree. I have repeatedly taken worms of the first brood, bred the moths from them, and obtained from these moths the second brood of worms; and I have done this both on enclosed fruit hanging on the tree in the open air, and on plucked fruit in-doors. In the latter experiments the moths would often cover an apple with eggs, so that when the worms hatched they would enter from all sides, and soon so thoroughly perforate and devour the fruit as to die of starvation. This is a clear case of misdirected instinct in the parent, caused doubtless by confinement.

From the foregoing facts, it becomes obvious that the rags or the hay-band should be kept around the tree, say from the first of May till the fruit is all off; and to be thoroughly effectual, the insects collected in or under them should be destroyed regularly every fortnight during that time.

There is a fact connected with the Codling Moth which, though of interest to entomologists is not generally known, and has never been published in this country. It has always been difficult to distinguish the sexes of this moth, but there is an infallible index recently pointed out by Mr. Zeller in his "Lepidopterologische Beobachtungen im jahre 1870." It consists of a black pencil or tuft of hairs of considerable length on the upper surface of the hind wings. It springs from a point close to the base of the wing and by the side of the median nervure, and lies in a groove running alongside of that nervure to about half the width of the wing, the groove forming a distinct carina on the under surface. The tuft when closely fitted into this groove is not easily noticed, but since my attention has been drawn to it, I have readily detected it on all my cabinet specimens, and it can easily be raised by the point of a needle.

Thus we find that important features are often revealed upon close scrutiny of our commonest insects, and the fact that this feature was so long overlooked in our Codling Moth should teach us to be all the more careful and cautious in our examinations and descriptions. Two similar instances of general oversight of common features in common insects were pointed out to me last fall by that excellent observer, Mr. J. A. Lintner, of the Agricultural Rooms, Albany, N.Y., who ascertained the facts that in the Butterfly genus *Argynnis* the males have invariably a beautiful fringe of hair on the sub-costa of the hind wings, while the females have not; and that in the genus *Grapta* the males have hairy front legs while the females have not.*

In my first Report (p. 65) I mentioned as an exceptional occurrence that this insect had been found quite injurious to plums around London, Ontario; but it has not hitherto been recorded as infesting peaches. Mr. Huron Burt, of Williamsburg, Callaway county, informs me, however, that three-fourths of the peaches in his vicinity were infested with this worm, and that it was more abundant in this stone-fruit than in apples, though its gnawings in the former are not followed by the same serious consequences as they are in the latter. In the peach the worm always lives near the stone, and bores no other holes through the flesh than the one required for egress, and the excrement is packed close to the stone, so that the fruit is generally but little injured for eating, cooking, drying or other purposes. Mr. Burt did not actually breed the moths from these peach-inhabiting worms, but as he is one of my most valued correspondents and an excellent observer and has paid considerable attention to insects, I have little doubt but that he is correct in concluding that they were the larvæ of the Coddling Moth, the more especially as he has furnished me, in detail, his reasons for this conclusion; but until the matter is settled beyond all doubt it would be premature to speculate farther on such a new and remarkable habit in such a common and well known insect.

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* The first mentioned feature, as a secondary sexual character, has long since been pointed out, and according to Mr. H. W. Bates (Trans. Linn. Ent. Soc., Vol. XXIII, p. 502, 1861) is common to all the tropical genera but two (*Lycorea* and *Ituna*) composing the Danoid *Heliconidæ*. Yet Mr. Lintner's observation is certainly original in this country, for, striking and useful as the feature is as a sexual characteristic, it is never given in the beautiful plates of Mr. Edwards's "Butterflies of North America."

THE CORN-WORM *alias* BOLL-WORM—*Heliothis armigera*, Hübner.

(Lepidoptera, Noctuidæ.)

This is a worm which is every year more or less destructive to our corn in the ear, and which was this year very injurious in many sections.

It has a very wide range, and a Mr. Bond, at the meeting of the London (England) Entomological Society, on March 1st, 1869, exhibited specimens of the moth from the Isle of Wight, from Japan, and from Australia; and, as might be expected from its extended habitat, the insect is a very general feeder. The "Boll-worm" has become a by-word in all the Southern cotton-growing States, and the "Corn-worm" is a like familiar term in those States, as well as in many other parts of the Union; but few persons suspect that these two worms—the one feeding on the corn, the other on the cotton-boll—are identically the same insect, producing exactly the same species of moth. But such is the fact, as I myself first experimentally proved in 1864. It attacks corn in the ear, at first feeding on the "silk," but afterwards devouring the kernels at the terminal end; being securely sheltered the while within the husk. I have seen whole fields of corn nearly ruined in this way, in the State of Kentucky, but nowhere have I known it to be so destructive as in Southern Illinois. Here, as in our own State, there are two broods of the worms during the year, and very early and very late corn fare the worst; moderately late and moderately early varieties usually escaping. I was formerly of the opinion that this worm* could not live on hard corn, and it certainly does generally disappear before the corn fully ripens, but last fall Mr. James Harkness, of St. Louis, brought me, as late as the latter part of October, from a corn field on the Illinois bottom, a number of large and well ripened ears, each containing from one to five worms of different sizes, subsisting and flourishing on the hard kernels. This is, however, an exceptional occurrence, brought about, no doubt, by the long protracted warm weather which we had, and the worms were in all probability a third brood.

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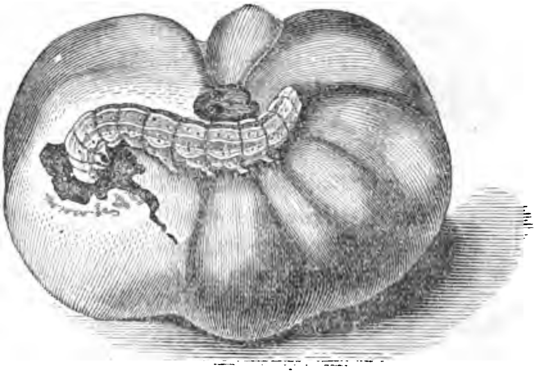
* Am. Ent. I, p. 212.

This glutton is not even satisfied with ravaging these two great staples of the country—cotton and corn—but, as I discovered in 1867, it voraciously attacks the tomato in South Illinois, eating into the green fruit, (Fig. 42), and thereby causing such fruit to rot. In this manner it often causes serious loss to the tomato-grower, and it may justly be considered the worst enemy to the tomato in that section of the country. Mr. Glover also found it feeding in a young pumpkin, and it has been ascertained by Mrs. Mary Treat of Vineland, New Jersey, not only to feed upon the undeveloped tassels of corn and upon green peas, but to bore into the stems of the garden flower known as Gladiolus, and in confinement to eat ripe tomatoes. Last summer it was also found by Miss M. E. Murtfeldt in common string beans, around Kirkwood, and in Europe it is recorded by M. Ch. Goureau* as not only infesting the ears of Indian corn, but as devouring the heads of hemp, and leaves of tobacco, and of lucern. The fact of its attacking a kind of pea, namely, the chick-pea or coffee-pea (*Cicer arietinum*) has also been recorded by M. J. Fallou (See *Insectologie Agricole*, 1869, p. 205) in certain parts of France, the young worms feeding on the leaves but the larger individuals boring through the pods and devouring the peas.

[Fig. 42.]



Thus it seems to be almost as promiscuous in its tastes as the Stalk-borer (*Gortyna nitela*, Guen.), which burrows in the stalks of the Potato, of the Tomato, of the Dahlia, of the Aster and other garden flowers, of the common Cocklebur and of Indian corn, besides boring into green corn-cobs and eating into green tomatoes and ripe strawberries, and in a single instance in Missouri eating into peach twigs, and in Illinois inhabiting the twigs of the Black Currant.†

But for the present we will consider this insect only in the two roles of Boll-worm and Corn-worm, because it is as such that it interests the practical man most deeply.

The egg from which the worm hatches (Fig. 43, *a* side view; *b*, top view magnified) is ribbed in a somewhat similar manner to that of the Cotton-worm, figured in my Second Report (p. 38) but may readily be distinguished by being less flattened, and of a pale straw color instead of green. It is usually deposited singly on the outside of the involucel or outer calyx of the flower or young boll, and each female moth is capable of thus consigning to their proper places, upwards of five hundred eggs. Mr. Glover, in his account of the Boll-worm, published in the Monthly Report of the Department of Agriculture for July, 1866, says: "Some eggs of the Boll-worm moth hatched in three or four days after being brought in from the field, the enclosed worms gnawing a hole through the shell of the egg and then escaping. They soon commenced feeding upon the tender fleshy substance of the calyx, near the place where the egg had been deposited. When they had gained strength, some of the worms pierced through the calyx, and others through the petals of the closed flower-bud, or even penetrated into the young and tender boll itself. The pistils and stamens of the open flower, are frequently found to be distorted and injured without any apparent cause. This has been done by the young Boll-worm; when hidden in the unopened bud, it has eaten one side only of the pistils and stamens, so that when the flower is open the parts injured are distorted and maimed, and very frequently the flower falls without forming any boll whatever. In many cases, however, the young worm bores through the bottom of the flower into the immature boll before the old flower falls, thus leaving the boll and involucel or envelope still adhering to the foot-stalk, with the worm safely lodged in the growing boll. The number of buds destroyed by this worm is very great, as they fall off when quite small, and are scarcely observed as they lie brown and withering on the ground beneath the plant. The instinct of the Boll-worm, however, teaches it to forsake a bud or boll about to fall, and either to seek another healthy boll, or to fasten itself to a leaf, on which it remains until at length it acquires size and strength sufficient to enable it to bore into the nearly matured bolls, the interior of which is nearly destroyed by its attacks, as, should it not be completely devoured, rain penetrates through the hole made by the worm, and the cotton soon becomes rotten and will not ripen. * * * * * * * *

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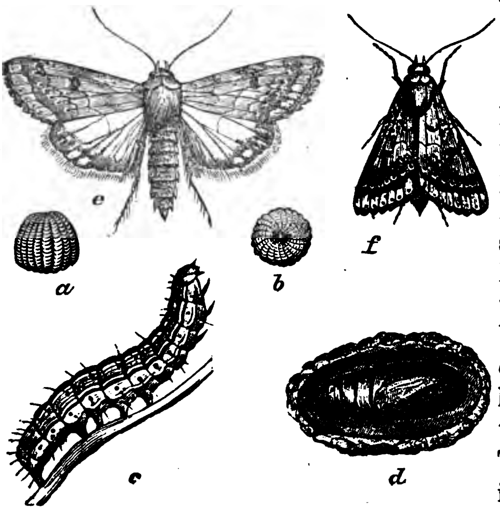
* *Insectes Nuisibles*, 2nd supplement, 1865, p. 132.

† See *Am. Ent.* I. p. 206; II. p. 13.

[Fig. 43.]



One thing is worthy of observation, and that is, whenever a young boll or bud is seen with the involucre spread open, and of a sickly yellow color, it may be safely concluded that it has been attacked by the Boll-worm, and will soon perish and fall to the ground. * * *

The buds injured by the worm may be readily distinguished by a minute hole where it has entered, and which, when cut open, will be found partially filled with small black grains, something like coarse gun powder, which is nothing but the digested food after having passed through the body of the worm."

This insect is very variable in the larva state, the young worms varying in color from pale green to dark brown. When full grown there is more uniformity in this respect, though the difference is often sufficiently great to cause them to look like distinct insects. Yet the same pattern is observable, no matter what may be the general color; the body being marked as in the above figures with longitudinal light and dark lines, and covered with black spots which give rise to soft hairs. Those worms which Mrs. Treat found in green peas and upon corn tassels had these lines and dots so obscurely represented that they seemed to be of a uniform green or brown color, and the specimens which I saw last summer in string beans were also of a dark glass green color with the spots inconspicuous, but with the stripe below the breathing pores quite conspicuous and yellow. The head, however, remains quite constant and characteristic. Figure 42 may be taken as a specimen of the light variety, and Figure 43, *c*, as illustrating the dark variety. When full grown, the worm descends into the ground, and there forms an oval cocoon of earth interwoven with silk, wherein it changes to a bright chestnut-brown chrysalis (Fig. 43, *d*), with four thorns at the extremity of its body, the two middle ones being stouter than the others. After remaining in the chrysalis state from three to four weeks, the moth makes it escape. In this last and perfect stage, the insect is also quite variable in depth of shading, but the more common color of the front wings is pale clay-yellow, with a faint greenish tint, and they are marked and varigated with pale olive and rufous, as in Figure 43, (*e* showing the wings expanded, and *f* representing them closed), a dark spot near the middle of each wing being very conspicuous. The hind wings are paler than the front wings, and invariably have along the outer margin a dark brown band, interrupted about the middle by a large pale spot.

Mr. Glover says that there are at least three broods each year in Georgia, the last brood issuing as moths as late as November. With us there are usually but two, though, as already hinted, there may be exceptionally three. Most of the moths issue in the fall, and hibernate as such, but some of them pass the winter in the chrysalis state and do not issue till the following spring. I have known them to issue, in this latitude, after the 1st of November, when no frost had previously occurred.

In 1860—the year of the great drought in Kansas—the corn crop in that State was almost entirely ruined by the Corn-worm. According to the *Prairie Farmer*, of January 31, 1861, one county there which raised 436,000 bushels of corn in 1859, only produced 5,000 bushels of poor wormy stuff in 1860; and this, we are told, was a fair sample of most of the counties in Kansas. The damage done was not by any means confined to the grain actually eaten by the worm; but "the ends of the ears of corn, when partially devoured and left by this worm, afforded a secure retreat for hundreds of small insects, which, under cover of the husk, finished the work of destruction commenced by the worm eating holes in the grain or loosening them from the cob. A species of greenish-brown mould or fungus grew likewise in such situations, it appearing that the dampness from the exuded sap favored such a growth. Thus decay and destruction rapidly progressed, hidden by the husk from the eye of the unsuspecting farmer." It appears also that many horses in Kansas subsequently died from disease, occasioned by having this half-rotten wormy corn fed out to them.

Remedies.—It is the general experience that this worm does more injury to very early and very late corn than to that which ripens intermediately, for though the broods connect by late individuals of the first and early individuals of the second, there is nevertheless a period about the time the bulk of our corn is ripening, when the worms are quite scarce. I have never yet observed their work on the green tassel, as it has been observed in New Jersey, and do not believe that they do so work with us. Consequently it would avail nothing as a preventive measure, to break off and destroy the tassel, and the only remedy when they infest corn is to kill them by hand. By going over a field when the ears are in silk, the presence of the worms can be detected by the silk being prematurely dry or by its being partially eaten.

In the South various plans have been adopted to head off the Boll-worm, but I believe none have proved very successful. The following experiment with vinegar and molasses, was made by B. A. Sorsby, of Columbus, Ga., as quoted by Mr. Glover:

"We procured eighteen common-sized dinner plates, into each of which we put half a gill of vinegar and molasses, previously prepared in the proportion of four parts of the former to one of the latter. These plates were set on small stakes or poles driven into the ground into the cotton field, one to about each three acres, and reaching a little above the cotton plant, with a six-inch square board tacked on the top to receive the plate. These arrangements were made in the evening, soon after the flies had made their appearance; the next morning we found eighteen to thirty-five moths to each plate. The experiment was continued for five or six days, distributing the plates over the entire field; each day's success increasing until the numbers were reduced to two or three moths to each plate, when it was abandoned as being no longer worthy of the trouble. The crop that year was but very little injured by the Boll-worm. The flies were caught in their eagerness to feed upon the mixture by alighting into it and being unable to escape. They were probably attracted by the odor of the preparation, the vinegar probably being an important agent in the matter. As the flies feed only at night, the plates should be visited late every evening, the insects taken out, and the vessels replenished as circumstances may require. I have tried the experiment with results equally satisfactory, and shall continue it until a better one is adopted."

Mr. J. M. Heard, of Monroe county, Wisconsin, patented in 1860, a device for trapping the moth, which consists of a tin plate placed on a funnel, which is connected with a bait-pan made of the same material, and which is to be partially filled with molasses mixed with a little anise, fennel or other essential oil. From one summer's test of the trap, I do not think much of it as a decoy for the moth, and it would be altogether too expensive, when the great number required to properly protect a large cotton field is taken into consideration.

THE FALL ARMY-WORM—*Prodenia antumnalis*, Riley.

[Lepidoptera, Noctuidæ.]

In 1868 the true Army-worm appeared in certain portions of the State and I gave a full account of it in my second Report. Last fall another worm very generally mistaken for that insect made its appearance very generally over the State, and caused considerable alarm. Specimens were sent to me from Moniteau, Jefferson, Pulaski and Cole counties, while it was common throughout the greater portion of the county of St. Louis.

The first notice I received of it was from the following item which appeared in the *Journal of Agriculture* of St. Louis:

ARMY-WORM.—*Editors Journal Agriculture:* Since Friday (26th August), the Army-worm has made its appearance in distressingly large numbers almost everywhere in this (Cole) county. They have destroyed for me more than an acre of turnips, a good deal of my late soiling corn, and are still on the march for more. Farther in the country they have eaten up the buckwheat, which is just coming into bloom. Could our esteemed friend RILEY give us an article in the next *Journal?—F. A. Nitchy.*

JEFFERSON CITY, Mo., August 29th, 1870.

The following published paragraphs, which all refer to this same worm, and which chanced to meet my eye, will give some idea of the extent of country through which it ranged.

FALL ARMY-WORM.—We have received specimens of the Fall Army-worm from several persons. The complaints of its ravages are quite numerous almost all over the State; they are very bad in northeast Missouri. Threatening at Tipton, from which place we have samples, and in St. Louis and Jefferson counties they are quite bad. This pest only returns at intervals, perhaps on account of parasitic and other enemies gaining the ascendancy over them.—*Rural World, Sept. 2nd,* 1870.

ARMY-WORM IN CALLAWAY COUNTY.—I have found that the Army-worm has been more or less on almost every farm, and have been examining some of the meadows over which they have passed, and have come to the conclusion they are about ruined. From my examination I think that nineteen-twentieths of the grass is entirely killed; at least there is not more than one bulb in twenty that shows any signs of vitality. Why should this insect make its appearance at this season? Mr. Riley, I believe claims that it makes its advent in the spring. But now we have it appearing at the end of summer and beginning of fall, and in numbers as great and as destructive as ever it did in spring. Could it be that the extreme heat of this season, with favorable conditions of moisture, has brought them forth prematurely? I noticed that some plum trees, cherry trees, smoke trees, summer roses and strawberries are blossoming freely from premature development.—*H. B., Journal of Agriculture, Oct. 13th,* 1870.

The Army-worm, on the 28th of August, appeared in force in my neighbor's wheat stubble, moving south towards a piece of land that I had planted in corn, and then sown in rye that was up nicely. When they reached the fence (which they did on the 28th of August), I scattered salt thickly on the rich blue grass on my side of the fence, all along it, while the dew was on. They came no further. As I was obliged to be away from home, I cannot say whether the salt checked them or not—at any rate, it caused the grass to wilt and die.

A very small dark worm about half an inch long, has been doing some damage to the young grain of late.—*J. L. Erwin, Fulton, Callaway County, Mo.*

THE ARMY-WORM—A SLANDER ON THE BIRDS—*Editor Farmer:* Feeling it a duty, as well as a privilege, to contribute all good, or even really bad news for the farmers, through your truly valuable and very much improved and highly esteemed Farmers' journal, enclosed (in a small phial) please find some specimens of Army-worm, many millions of which infest our county. They are everywhere. It is said they are brought by a small, yellow bird, which goes in covies of twenty-five to two hundred—that wherever they alight, the worms first appear. It is said that each petaled portion of the feathers is covered with nits, and their number is legion.

We would be pleased to hear from some of our scientific men on the subject, as we are very much interested. They take a twenty-acre wheat field in two days.

These pestiferous little pests are rapidly arriving at maturity. In traveling, their course seems westward. They last appeared here in 1866, but too late in the season to do any great damage, as a cold rain sent them the way of all the earth. That being in October, nothing of the kind can be expected at this time; and if they are to remain here until October, woe to our wheat fields in this vicinity!

MINERAL POINT, Kansas, Aug. 29th, 1870.

[The above letter came to us too late for insertion last month. Our friends are doing great injustice to our little harmless "Prairie-birds," in supposing that they have anything to do with bringing the Army-worm—EDITOR].—*Kansas Farmer, October,* 1870.

ARMY-WORM.—Late rains are keeping corn too green. Too muddy to plow for wheat. The Hessian-fly and Army-worm are too numerous to allow farmers to seed much this fall. The early sown wheat and much of the meadows are eaten up by the Army-worm. Dr. C' W. Thornton, of Warrensburg, Kansas, in *Kansas Farmer*.

ARMY-WORM.—We have received from S. S. Tipton, of Mineral Point, a specimen of the above genius, but a little the worst demoralized specimen we ever saw. The bottle was broken, and, as well as we can determine, by the aid of a powerful magnifying glass, the worm is in about sixty thousand pieces. We shall refer to the subject in our next; but in the mean time, we advise our friends to plow and scrape out ditches, in which to spread dry straw. Then muster your force armed with brushes, drive them into the ditches, and set fire to the straw. We have seen them very successfully treated in this way. *Kansas Farmer.*

Thus in all the above accounts this worm was supposed to be a fall brood of the true Army-worm, and in the following letter, we shall see that it was also mistaken for the Corn-worm treated in the last article—a mistake not at all surprising considering the close resemblance between the two worms,

C. V. Riley, Dear Sir.—I herewith send you a box of what I believe to be the Boll-worm although its actions here were similar to the true Army-worm. At my father's and in the neighborhood they complain too of *the Army-worm* eating up the young oats and timothy. With me they commenced about two weeks ago in a field of young oats, or rather oat stubble which had been plowed under and sown to buck-wheat. The oats had got to be about six inches high and were eaten first, next the worm took what little crab grass they could find and they are now scattered, eating grass, corn silks, soft corn, ruta-baga leaves and whatever in the grass line comes before them. They have not entered my meadow yet, nor a piece of wheat stubble which is plowed under. G. PAULS.

Eureka, Mo., Sep., 7, 1870.

On the farm of Jno. J. Squires at DeSoto, this worm at first ate off all the grass, then completely stripped the leaves from some corn-fodder, injured his corn, ate into his tomatoes and ruined his turnips —injuring his crops to the amount of nearly $1,000.

In some cases the worm acted strangely, and I have know it to take a whole field of rye in preference to wheat. Judge Wielandy, of Cole county informs me that it was abundant on his potatoes, cutting off the lateral stems. It invaded a large cucumber field and entirely cleaned out the crab grass, and would have injured his cucumbers had he not applied slacked lime. In some parts of Jefferson county it was very abundant and destructive, and Senator J. H. Morse, of Morse's Mills had twenty acres badly injured by it. I have also been informed that in some vineyards it did great damage by gnawing around the stems and causing the bunches to drop off and fall to pieces so that the grapes would scatter on the ground. But I cannot vouch for the correctness of the observation. With me it did more injury to corn than to anything else. It not only greedily devours the leaves and stems, but bores large holes through the ears, burrowing in them in all directions. On late corn it is frequently found in the same ear with the Corn-worm, *alias* Cotton Boll worm. The Boll-worm is, however, rougher, generally paler, striped differently (see Figs. 42 and 43, *c*,), and always readily distinguished by having a larger gamboge-yellow or reddish head, which invariably lacks the distinct white inverted Y-shaped mark, and the darker shadings of the head of the Fall Army-worm.

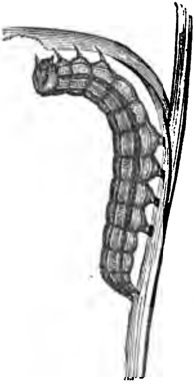
Now, until the present year nothing was absolutely known of the natural history of this worm, and though I knew that it was not the true Army-worm, and suspected, from comparing it with the description of certain corn-feeding worms received in 1868 from Mr. E. Daggy, of Tuscola, Illinois, that it would produce a certain moth which I bred from Mr. Daggy's worms—yet I could not feel positive without breeding the Fall Army-worm to the perfect state. This I very luckily did, and I am therefore able to give its complete history.

In the fall of 1868 I received a few specimens from Mr. T. R. Allen, of Allenton, with an account of their injuring newly sown wheat on oat stubble, and on page 88 of my first Report it was briefly described by the name of Wheat Cut-worm. The popular term of "Fall Army-worm" is, however, altogether more indicative than that of "Wheat Cut-worm," since the species does not confine its attacks to wheat, and not only very closely resembles the Army-worm in appearance but has many habits in common.

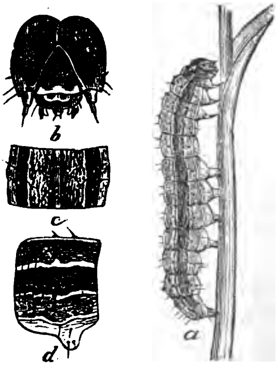
HOW IT DIFFERS FROM THE TRUE ARMY-WORM.

The two insects need never be confounded, however. The true Army-worm never appears in the fall of the year, but always about the time when wheat is getting beyond the milk state; and it generally disappears, in the latitude of St. Louis, by the first of June. It confines its attacks entirely to the grasses and cereals, whereas the species under consideration is a much more general feeder, devouring with equal relish most succulent plants, such as wheat, oats, corn, barley, grasses, purslane, turnips, and, as Mr. J. M. Jordan of St. Louis informs me, even spruces. Moreover, when critically examined, the two worms show many characteristic differences, as will be seen by comparing Figure 44, which represents the true Army-worm, with Figure 45, which represents at *a* the Fall Army-worm natural size, at *b* its head magnified, at *c* a magnified dorsal view of one of the joints, and at *d* a magnified side view of same.

[Fig. 44.]

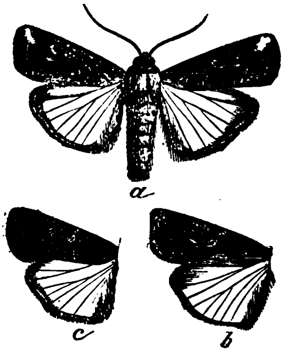


[Fig. 45.]



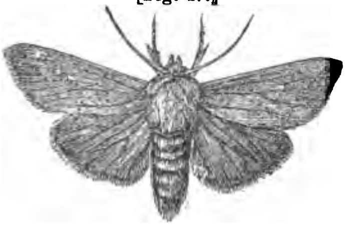
Our Fall Army-worm moth is a most variable one—so variable, indeed, that at least three species might easily be fabricated by any species-grinder who happened to capture at large the three most distinct varieties, without knowing anything of their transformations. I have bred 31 specimens, all from larvæ found on corn, and have others which were captured at large, and though half a dozen sufficiently distinct varieties might easily be picked out from among them, and though scarcely any two are precisely alike, yet they may all be divided into three distinct sets or varieties. The first of these, which is the more common, is represented at Figure 46, *a*, the second at *b*, and the third at *c*. For those who are more curious in such matters I append, at the end of this article, a more elaborate description of this new moth. Not only do I find this great variation in this particular species, but all the species of the genus to which it belongs are variable; and Guenée has truly remarked that they resemble each other so closely, and their modifications are so complicated, that it is next to impossible to properly separate them. By comparing the annexed Figures 46 *a*, *b* and *c*, with that of the true Army-worm moth (Fig. 47) the two insects will be found to differ widely.

[Fig. 46.]



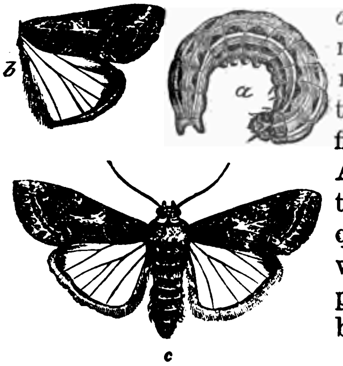
We have in this country a very common moth (*Prodenia commeinœ*, Abb.) which may be popularly called the Spiderwort Owlet moth, some of the varieties of which approach so nearly to some of the more strongly marked varieties of our Fall Army-worm moth that it is necessary to show the very great difference which really exists between them, in order that the cultivator may not be unnecessarily alarmed when he observes the former, by confounding it with the latter, and erroneously inferring that he will be overrun with Fall Army-worms when there is no real danger.

[Fig. 47.]



The Spiderwort Owlet moth, (Fig. 48, *b* and *c*) is a handsomer and more distinctly marked species, the front wings inclining more to vinous-gray, or purplish-gray, and the ordinary lines being more clearly defined by very deep brown, than in the Fall Army-worm moth. But, however much these characters may vary—and they are quite variable—there are yet two others which will be readily noticed upon comparing the figures of the two species, and by which the Spiderwort moth may always

[Fig. 48.]



be distinguished from its close ally, namely, by the tip of the wing being more prolonged and acuminate, and by the three-forked nerve in the middle of the wing being much more conspicuous. Its larva never congregates in multitudes as does the Fall Army-worm, and differs so materially from that worm, and is withal so characteristically marked, that it may be recognized at once by the above illustration (Fig. 48, *a*). Contrary to what its name would indicate, it is a very general feeder, as I have found it on all sorts of succulent plants, both wild and cultivated, This insect is more or less numerous every year, but has never been known to multiply so prodigiously as the Fall Army-worm, which we have under consideration. It passes the winter either in the larva, pupa or perfect state, but more generally in the former.

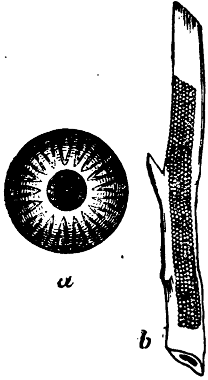
REMEDIES.

Now that I have sufficiently dwelt on the characteristics of the Fall Army-worm to enable any one to distinguish it, even from its nearest relative, let us consider for a moment what can be done to prevent its great injuries to grains and to vegetables. I have proved that there are at least two, and probably as many as three or even four broods during the course of the year; for those worms which appeared in such multitudes in August and the forepart of September, in due time produced moths, and these gave birth to a new generation of worms, which began to make their presence manifest towards the end of October. In 1868, also, I bred the moth as early as July, from worms received from Mr. Daggy. In this prolificacy the Fall Army-worm differs remarkably from the true Army-worm, as well as from most of its close allies, which generally produce but one, and seldom more than two, broods each year.

The moths were so numerons during the latter part of September and the forepart of October, that I not only found them common at Decatur, Vandalia and other parts of Central Illinois, and wherever I traveled in our own State, but I captured a goodly number in the very heart of St. Louis, and even caught some while riding by rail.

The eggs are deposited in small clusters, often in two or three layers one above the other, and the whole cluster is covered sparsely with the yellowish hairs from the ♀ abdomen. Each egg is nearly spherical, of a pale fulvous color, and differs only from that of the Unarmed Rustic (*Agrotis inermis,* Fig. 49, *a*, showing one magnified, and *b*, a batch of natural size,) in being less compressed and less distinctly ribbed. The clusters were found abundantly, not only on the under side of peach and apple leaves, which the worms readily devour, but on the leaves of such trees as sycamore, which, so far as we at present know, they do not feed upon. Under these last circumstances the young worms, upon hatching, would soon descend the tree to feed upon the more succulent herbage below: and the more I learn of the habits of our different Owlet moths

[Fig. 49.]



the more I become convinced that the long-accepted theory of their eggs being deposited on the ground is a false one, and that most of our cut-worms though fat, lazy and groveling in the ground when we find them, have been born in more elevated and exalted positions.

In the fall of 1868 this worm proved very destructive to the newly sown wheat in many parts of Franklin and St. Louis counties, Mo., and seemed to be confined to such wheat as was sown on oats stubble. I then accounted for this singular state of things by supposing that the scattering oats which were left after harvest had sprouted before the wheat, and had thus attracted the parent moths*; and, acting upon this supposition, I suggested that the attacks of the worm might effectually be prevented by plowing the land early and keeping the ground clear of all vegetation until the wheat was planted. This inference proves to be well warranted by the facts; and in future, when the Fall Army-worm is heard of during the months of August or September, as it was the present year, it will be wise for those who live in the immediate neighborhood, either to sow no fall grain at all or to endeavor, in doing so, to carry out the above suggestions. The last brood of worms, which at this writing (Nov. 7th) are not yet quite full grown, must evidently pass the winter in the ground, either in the larva or the pupa state. In either case a great many of them would be killed by late fall plowing which should be used, when practicable, as a remedial measure in fields where this insect has been numerous. When the worms are overrunning a field of fall grain, most of them could be destroyed by means of a heavy roller, without injury to the grain.

The question has been repeatedly asked: "Will this worm be as numerous next year as it has been this; or will it go on increasing in geometrical ratio, and be still more numerous?" Now, although I greatly dislike to weaken the confidence that some people seem to place in the oracular power of an entomologist to peer into the future, yet I must meekly confess my inability to give any definite answer to such questions.

Byron has truly said that, "the best of prophets of the future is the past;" and we may reasonably draw the inference that this worm will *not* be so abundant next year, because in the past it has only occasionally been so troublesome, and never, so far as the record shows, during two consecutive years. And we may rest tolerably well assured that it will not increase in geometrical ratio, because most vegetable feeding insects are preyed upon by more predaceous species and by parasites,* and because such continued increase of one species is inconsistent with the harmony we find everywhere in Nature. But we may not venture beyond the inference, as the happenings of the future are not for mortals to know. Some persons may also be curious to learn why this worm increases so much more in late summer and fall than in spring, since there are so many broods during the year; or why it is only noticed in certain years? Such questions, likewise, can receive no definite answer,

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*Report I, p. 88.

> "Till old experience do attain
> To something like prophetic strain."

For though, to meet the first, we may assume that the winter decimates their numbers, or that the spring weather is not favorable to their increase; and to meet the last we may conjure up a hundred reasons, yet assuming is not knowing, and we must content ourselves with the facts as they occur.

In conclusion, it will afford a grain of comfort to those who have had wheat fields cleaned off by this worm, to know that their wheat is not necessarily ruined; for, as I personally ascertained, wheat that had been thus cut off in the fall of 1868 made a good stand the following spring; and in one instance, where part of a field had been invaded and the rest left untouched, it really appeared that the part which had been eaten off yielded the heaviest. Mr. Huron Burt, of Callaway county, Mo., also informs me that this insect always leaves blue-grass untouched.

PRODENIA AUTUMNALIS, Riley.—*Imago* (Fig. 46, *a*, *b* and *c*.)—*Front wings* narrow with the apex usually well rounded, and with the middle of the hind margin sometimes, but not often, extending beyond apex: general color mouse-gray variegated with smoky-brown, fulvous and pearly or bluish-white; apical patch bluish-white and never extending beyond nerve 5: the subterminal line—which is pale and bends like a bow, approaching nearest the terminal line between nerves 3 and 4—generally blends with this patch so as to appear to start from its lower edge, but is sometimes well separated from it so as to be traced further towards apex: dark space preceding subterminal line, confined between nerves 3 and 5, blending gradually with the rest of the wing, barely showing two darker sagittate spots: transverse anterior and transverse posterior either subobsolete or tolerably well defined, each by a geminate dark line: basal area divided longitudinally by an irregular dark line, the wing below it quite light-colored: orbicular spot large and elongated, a little lighter than surrounding surface, and well defined by a fulvous annulation, the pale oblique shade which generally encloses it in this genus confined to a fulvous shade above, and either a more distinct fulvous line behind or none at all: reniform spot generally dark, but sometimes lighter than space preceding; not well defined, the small pale spot at top being generally distinct, and either partaking of the same form, or resembling the small letter *e* [left wing]; the lower edge occupied by a distinct white dash, which however never extends beyond it and but seldom shows any tendency to furcate with the nerves: four tolerably distinct equidistant pale costal spots from reniform spot to apical patch: terminal line pale, even, parallel with posterior margin: terminal space dark, except near apex and anal angle, divided into subquadrate spots by the pale nerves: fringe either broad or narrow, of same color as wing, with a narrow darker inner line, relieved by two very fine paler ones which are barely distinguishable: under surface smoky, but paler interiorly and terminally, and fulvous along costa; the whole with a nacreous lustre and more or less irrorate with brown, and often with a flesh-colored tint near apex; fringes dark. *Hind wings* white with a faint fulvous tint; semi-transparent and slightly irridescent, with extremities of nerves and borders, especially above, brown; fringes dusky, especially at apex, and with a paler inner line; under surface similar. Thorax, abdomen and legs of same general color as front wings, being paler below; the longer lateral and anal abdominal hairs more fulvous. Sexes with difficulty distinguished, the size and shape of the abdomen not even being a safe criterion. Maximum expanse 1.40; minimum expanse 1.05 inches. Described from 18 specimens, bred Sept. 20th—Oct. 10th, from corn-fed larvæ.

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* Many of the Fall Army-worms had the thoracic joints of the body more or less covered with the eggs of a *Tachina* fly, and I have bred from the worms the same parasite (*Exorista leucaniæ*, Kirk; 2d Rep. Fig. 17) which infests the true Army-worm, and still another allied species (*Tachina archippivora*) which infests the larvæ of the Archippus butterfly, and will be referred to on a future page.

VARIETY FULVOSA, (Fig. 46, *b.*)—*Front wings* greatly suffused with fulvous, especially in the lower median space, which often inclines to ochraceous; apical space more or less defined; oblique median band distinct to median nerve, and orbicular spot with an ochre-colored centre. Described from 5 specimens, bred Sept. 25th—Oct. 3rd, from corn-fed larvæ.

VARIETY OBSCURA, (Fig. 46, *c.*)—*Front wings* of a much more uniform and darker color, either grayish-brown with a slight vinous tint, or deep smoky brown inclining to black, or a deep warm brown with but little gray; apical space either entirely obsolete or but very faintly indicated; oblique fulvous band across upper middle of wing also obsolete; the ordinary lines either entirely obsolete [one specimen only] or distinctly marked; the ordinary spots sometimes obsolete, but more generally indicated by fulvous lines. Described from 8 specimens, bred Sept. 21st—Oct. 2d, from corn-fed larvæ.

Larva, (Fig. 45, *a.*)—Ground-color very variable, generally dark and pitchy-black when young, but varying after the last moult from pale brown to pale dirty green, with more or less pink or yellow admixed—all the markings produced by fine, more or less intense, brown, crimson and yellow mottlings. Dorsum brownish with a narrow line down the middle, rendered conspicuous by a darker shade each side of it. A dark, subdorsal band one-third as wide as each joint is long; darkest at its upper edge, where it is bordered and distinctly separated from dorsum by a yellow line which, except on joint 11 where it deflects a little upwards, is quite straight; paler in the middle of each joint. A pale, either buff or flesh-colored, substigmatal band, bordered above and below by a narrow, yellow and wavy line. Venter pale. Head pale yellowish-brown, with sometimes a tinge of green or pink; the triangular piece yellowish, the Y-mark distinct and white, the cheeks with four more or less distinct lateral brown lines and with dark brown mottlings and nettings, which become confluent and form a dark curved mark at the submargin behind the prongs and each side of the stem of the Y. Stigmata large, brown, with a pale annulation, and just within the lower edge of the dark subdorsal band. Legs either light or dark. Cervical shield darker than body, with the narrow dorsal and subdorsal lines extending conspicuously through it: anal plate also dark, narrow and margined by the pale subdorsal lines—both plates furnishing stiff hairs, but without tubercles. Piliferous tubercles on joints 2 and 3, arranged in a transverse row, and quite large, especially on joint 2; on joints 4–10 inclusive the superior eight are arranged as follows: 4 in a trapezoid in dorsal space, the posterior two as far again from each other as the anterior two, and two near stigmata, one above and one behind; on joint 11 the dorsal 4 are in a square, and on joint 12 in a trapezoid, with the posterior and not the anterior ones nearest together: the thoracic joints have each a large subventral tubercle just above the legs. Length 1.10–1.50 inch. Described from numerons specimens.

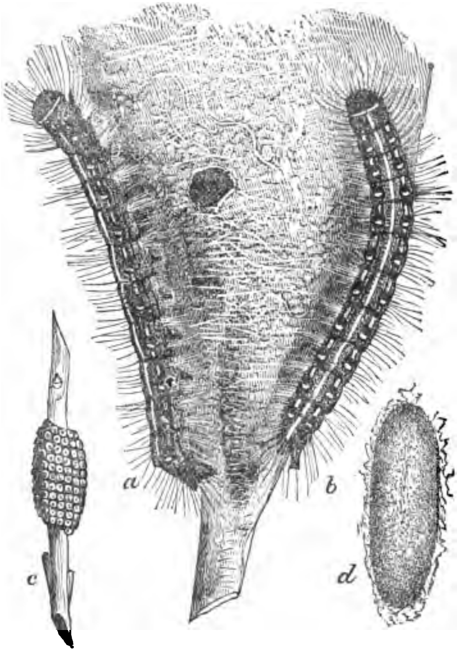
Pupa.—Formed in the ground, without cocoon; of normal form, bright mahogany-brown, and with a distinct forked point at extremity.

THE APPLE-TREE TENT-CATERPILLAR, OR AMERICAN LACKEY MOTH.—*Clisiocampa Americana,* Harr.

(Lepidoptera, Bombycidæ.)

What orchardist in the older States of the Union is not familiar with the white web-nests of this caterpillar? As they glisten in the rays of the spring sun, before the trees have put on their full summer dress, these nests, which are then small, speak volumes of the negligence and slovenliness of the owner of the orchard, and tell more truly than almost anything else why it is that he fails and has bad luck with his apple crop. Wherever these nests abound one feels morally certain that the borers, the Codling-moth, and the many other enemies of the good old apple tree, mentioned in the beginning of this Report, have full play to do as they please, unmolested and unnoticed by him whom they are ruining; and when I pass through an orchard with two, three or more "tents" on every tree, I never pity the owner, because there is no insect more easily kept in check.

[Fig. 50.]



The small, bright and glistening web, if unmolested, is soon enlarged until it spreads over whole branches, and the caterpillars which were the architects, in time become moths, and lay their eggs for an increased supply of nests another year.

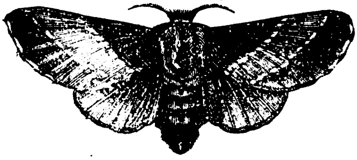
This insect is so well known throughout the country, and has been so well treated of by Harris and Fitch, that it is only necessary to give here the most prominent and important points in its history, the more especially as the figures alone which are given herewith will enable the novice to recognize it the moment it appears in a young orchard. Though some years quite abundant, it is not as common with us as in some of the Eastern States.

The eggs (Fig. 50, *c*) from which these caterpillars hatch are deposited mostly during the month of June, in oval rings, upon the smaller twigs, and this peculiar mode of deposition renders them conspicuous objects during the winter time, when by a little practice they can easily be distinguished from the buds, knots or swellings of the naked twigs. Each cluster consists of from two to three hundred eggs, and is covered and protected from the weather by a coating of glutinous matter, which dries into a sort of net-work. The little embryonic larvæ are fully formed in the egg by the commencement of winter, and the same temperature which causes the apple-buds to swell and burst, quickens the vital energies of these larvæ and causes them to eat their way out of their eggs. Very often they hatch during a prematurely warm spell and before there is any green leaf for them to feed upon, but they are so tough and hardy that they can fast for many days with impunity, and the glutinous substance on the outside of their eggs furnishes good sustenance and gives them strength at first. It is even asserted by Mr. H. C. Raymond, of Council Bluffs, Iowa, that the eggs often hatch in the fall and that in these cases the larvæ withstand the severity of the winter with impunity.

The young caterpillars commence spinning the moment they are born, and indeed they never move without extending their thread wherever they go. All the individuals hatched from the same batch of eggs work together in harmony, and each performs its share of building the common tent, under which they shelter when not feeding and during inclement weather. They usually feed twice each day, namely, once in the forenoon and once in the afternoon. After feeding for five or six weeks, during which time they change their skins four times, these caterpillars acquire their full growth, when they appear as at Figure 50 (*a* side view, *b* back view) the colors being black, white, blue and rufous or reddish. They then scatter in all directions in search of some cozy and sheltered nook, such as the crevice or angle of a fence, and having finally decided on the spot, each one spins an oblong-oval yellow cocoon (Fig. 50, *d*) the silk composing which is intermixed with a yellow fluid or paste, which dries into a powder looking something like sulphur. A few individuals almost always remain and spin up in the tent, and these cocoons will be found intermixed with the black excrement long after the old tent is deserted.

Within this cocoon the caterpillar soon assumes the chrysalis state, and from it, at the end of about three weeks, the perfect insect issues as a dull yellowish-brown or reddish-brown moth (Fig. 51), characterized chiefly by the front wings being divided into three nearly equal parts by two transverse whitish, or pale yellowish lines, and by the middle space between these lines being paler than in the rest of the wing in the males, though it is more often of the same color, or even darker in the females. The species is, however, very variable.*

[Fig, 51.]



The moths do not feed, and the sole aim of their lives seems to be the perpetuation of their kind; for as soon as they have paired and each female has carefully consigned her eggs to some twig, they die, and when the proper time comes around again the eggs will hatch, and the same cycle of changes takes place each year.

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* Dr. Fitch, in the very excellent and detailed account of this insect in his second Report, shows how very variable the moth is, and from a large series of bred and captured specimens, I can fully corroborate the fact. I have specimens which are of an almost uniform pale tawny-yellow, while others are very dark, being what might be termed a bay-brown with the pale markings conspicuous, while others have a pale band across the hind wings so conspicuous as to very closely resemble the European *neustria*. Dr. Fitch in referring to his figures must certainly have made a mistake, for he calls Figure 4 the female and Figure 3 the male, while the reverse is apparent from the figures themselves. My own figure is intended to represent the female, but the middle space of the upper wings seldom if ever appears so light in this sex, as the engraver has erroneously represented.

This insect in all probability extends wherever the wild black cherry (*Cerasus serotina*) is found, as it prefers this tree to all others; and this is probably the reason why the young so often hatch out before the apple buds burst, because, as is well known, the cherry leafs out much earlier. Besides the Cherry and Apple, both wild and cultivated, the Apple-tree Tent-caterpillar will feed upon Plum, Thorn, Rose and perhaps on most plants belonging to the Rose family, though the Peach is not congenial to it, and it never attacks the Pear, upon which, according to Dr. Trimble, it will starve. It does well on Willow and Poplar and even on White Oak, according to Fitch, who also found it on Witch Hazel (*Hamamelis*) and Beech.

REMEDIES.

Cut off and burn the egg-clusters during winter, and examine the trees carefully in the spring for the nests from such clusters that may have eluded the winter search. The eggs are best cut off in the manner presently to be described for the Tent-caterpillar of the Forest. Though to kill the caterpillars numerous methods have been resorted to, such as burning, and swabbing with oil, soap-suds, lye, etc., they are all unnecessary, for the nests should not be allowed to get large, and if taken when small are most easily and effectually destroyed by going over the orchard with the fruit-ladder, and by the use of gloved hands. As the caterpillars feed about twice each day, once in the forenoon and once in the afternoon, and as they are almost always in their nests till after 9 A. M., and late in the evening, the early and late hours of the day are the best in which to perform the operation. As a means of facilitating this operation, it would be a good plan, as Dr. Fitch has suggested, to plant a few wild cherry trees in the vicinity of the orchard, and as the moths will mostly be attracted to such trees to deposit their eggs, and as a hundred clusters on a single tree are destroyed more easily than if they were scattered over a hundred trees, these trees will well repay the trouble wherever the Tent-caterpillar is known to be a grievous pest.

The chrysalids of this caterpillar are often found filled with little maggots, which produce minute Chalcididan 4-winged flies of metallic green and black colors,* and belonging to the very same genus as the celebrated Hessian-fly parasite. This parasite, with other cannibal insects, and perhaps more or less favorable seasons, tend to produce a fluctuation in the numbers of these caterpillars, so that they are more numerous some years than others, and they were more numerous in 1868 than they have been since. It has also been noticed that dry summers are injurious to them. According to Dr. LeBaron, the Baltimore Oriole occasionally pecks at the nests, but does not make a common article of diet of the caterpillars, and the only birds that devour them greedily are the American Cuckoos (*Coccyzus Americanus* and *erythrophthalmus*).

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* Described as *Cleonymus clisiocampæ* by Dr. Fitch (Rep., vol. I, p. 200), but subsequently more properly referred to the genus *Semiotellus* (Rep., Vol. III, p. 141.

THE TENT-CATERPILLAR OF THE FOREST—*Clisiocampa sylvatica*, Harr.

(Lepidoptera, Bombycidæ.)

There is another insect which in all its stages so closely resembles the Apple-tree Tent-caterpillar as to be very generally confounded with it. This insect was first described by the great Massachusetts entomologist, Dr. Harris, and very appropriately named the Tent-Caterpillar of the Forest, the better to distinguish it from the other species which is more common in our orchards. He, however, unqualifiedly states that it lives in communities under a common web or tent; but with this exception gives a very clear and truthful account of it.* It has been quite destructive in many parts of Missouri during the past two summers, and as I have had good opportunities of studying its habits I shall endeavor to dispel the confusion and uncertainty about them which have hitherto existed in the minds of most of our farmers.

ITS NATURAL HISTORY.

The egg-mass from which the Tent-caterpillar of the Forest hatches (Fig. 52, *a*, showing it after the young larvæ have escaped) may at once be distinguished from that of the common Tent-caterpillar by its being of a uniform diameter, and docked off squarely at each end. It is usually composed of about 400 eggs, the number in five masses which I counted ranging from 380 to 416. Each of the eggs composing this mass is of a cream-white color, 0.04 inch long and 0.025 inch wide, narrow and rounded at the attached end or base, gradually enlarging towards the top, where it becomes slightly smaller (Fig. 52 *d*), and abruptly terminates with a prominent circular rim on the outside, and a sunken spot in the centre (*c*). These eggs are deposited in circles, the female moth stationing herself, for this purpose, in a transverse position across the twig. With abdomen curved she gradually moves as the deposition goes on, and when one circle is com-

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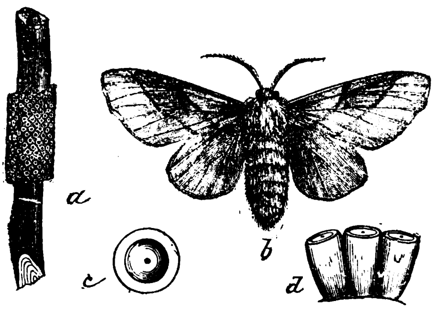
* Inj. Ins. p. 376.

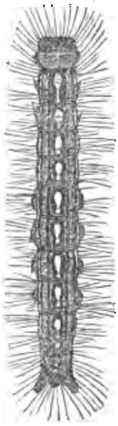
[Fig. 52.]



pleted, she commences another—and not before. With each egg is secreted a brown varnish which firmly fastens it to the twig and to its neighbor, and which, upon becoming dry, forms a carinated net-work of brown over the pale egg-shell. These eggs are so regularly laid and so closely glued to each other, and the sides are often so appressed, that the moth economizes space almost as effectually as does the Honey-bee in the formation of its hexagonal cells. In confinement the moth very seldom succeeds in forming a perfect ring, but in her abortive attempts, deposits them in different sized patches; and as I have found such unfinished patches attached to an oak leaf out-of-doors, we may conclude that either from injury or debility of some kind, the parent's instinct sometimes fails it even when all the conditions are normal and natural.

The eggs are deposited, in the latitude of St. Louis, during the latter part of June. The embryo develops during the hot summer weather, and the yet unborn larva is fully formed by the time winter comes on. The young hatch with the first warm weather in spring—generally from the middle to the last of March—and though the buds of their food-plant may not have opened at the time, and though it may freeze severely afterwards, yet these little creatures are wonderfully hardy, and can fast for three whole weeks, if need be, and withstand any amount of inclement weather. The very moment these little larvæ are born, they commence spinning a web wherever they go. At this time they are black with pale hairs, and are always found either huddled together or traveling in file along the silken paths which they form when in search of food. In about two weeks from the time they commence feeding they go through their first moult, having first grown paler or of a light yellowish brown, with the extremities rather darker than the middle of the body, with the little warts which give rise to the hairs quite distinct, and a conspicuous dark interrupted line each side of the back. After the first moult, they are characterized principally by two pale yellowish subdorsal lines, which border what was before, the dark line above described. After the second moult, which takes place in about a week from the first, the characteristic pale spots on the back appear, the upper pale line becomes yellow, the lower one white, and the space between them bluish; indeed, the characters of the mature larva are from this period apparent. Very soon they undergo a third moult, after which the colors all become more distinct and fresh,

[Fig. 53.]



the head and anal plate have a soft bluish velvety appearance, and the hairs seem more dense. After undergoing a fourth moult without material change in appearance, they acquire their full growth in about six weeks from the time of first feeding. At this time they appear as at Figure 53, and for those who are interested in such matters, I quote below Dr. Fitch's description of the full-grown larva, as it is the first accurate and detailed description that was published, and as I have occasion to refer to it further on:

"The caterpillar, as seen after it has forsaken its nest and is wandering about, is an inch and a half long and 0.20 thick. It is cylindrical and of a pale blue color, tinged low down on each side with greenish gray, and is everywhere sprinkled over with black points and dots. Along its back is a row of ten or eleven oval or diamond-shaped white spots which are similarly sprinkled with black points and dots, and are placed one on the fore part of each segment. Behind each of these spots, is a much smaller white spot, occupying the middle of each segment. The intervening space is black, which color also forms a border surrounding each of the spots, and on each side is an elevated black dot from which arises usually four long black hairs. The hind part of each segment is occupied by three crinkled and more or less interrupted pale orange-yellow lines, which are edged with black. And on each side is a continuous and somewhat broader stripe of the same yellow color, similarly edged on each of its sides with black. Lower down upon each side is a paler yellow or cream-colored stripe, the edges of which are more jagged and irregular than those of the one above it, and this stripe also is bordered with black, broadly and unevenly on its upper side and very narrowly on its lower side. The back is clothed with numerous fine fox-colored hairs, and low down on each side are numerous coarser whitish ones. On the under side is a large oval black spot on each segment except the anterior ones. The legs and prolegs are black and clothed with short whitish hairs. The head is of a dark bluish color freckled with numerous black dots and clothed with short blackish and fox-colored hairs. The second segment* or neck is edged anteriorly with cream white, which color is more broad upon the sides. The third and fourth segments have each a large black spot on each side. The instant it is immersed in spirits the blue color of this caterpillar vanishes and it becomes black.

At this stage of its growth the Tent-caterpillar of the Forest may be seen wandering singly over different trees, along roads, on the tops of fences, etc., in search of a suitable place to form its cocoon. It usually contents itself with folding a leaf or drawing several together for this purpose, though it frequently spins up under fence boards and in other sheltered situations. The cocoon is very much like that of the common Tent-caterpillar, being formed of a loose exterior covering of white silk with the hairs of the larva interwoven, and by a more compact oval inner pod that is made stiff by the meshes being filled with a thin yellowish paste from the mouth of the larva, which paste, when dried, gives the cocoon the appearance of being dusted with powdered sulphur exactly as in that of the other species. Three days after the cocoon is completed the caterpillar casts its skin for the last time and becomes a chrysalis of a reddish-brown color, slightly dusted with a pale powder, and densely clothed with short pale yellow hairs, which at the blunt and rounded extremity are somewhat larger and darker. In a couple of weeks more, or during the forepart of June, the moths commence to issue, and fly about at night. This moth (Fig. 52, *b* ♀) bears a considerable resemblance to that of the Common Tent-caterpillar (Fig. 51), being of a brownish-yellow or rusty-brown, and having two oblique transverse lines across the front wings. It differs, however, in the color being paler or more yellowish, especially on the thorax; in the space between the oblique line being, even in the males, usually darker instead of lighter than that on either side; but principally in the oblique lines themselves being always dark instead of light, and in a transverse shade, often quite distinct, across the hind wings. As in *Americana*, the male is smaller than the female, with the wings shorter and cut off more squarely. Considerable variation may be found in a given number of moths, but principally in the space between the oblique lines on the front wings being either of the same shade as the rest of the wing, or in its being much darker; but as I have found these variations in different individuals of the same brood, bred either from Oak, Hickory, Apple and Rose, they evidently have nothing to do with the food-plant. The scales on the wings are very loosely attached, and rub off so readily that good specimens of the moth are seldom captured at large. So much for the natural history of our Forest Tent-caterpillar.

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* It is necessary to remark here that in the above description, Dr. Fitch reckons the head as the first segment and the first leg-bearing segment of the body, which he calls the neck, as the second segment. If Lepidopterists could be induced to adopt some uniform rule in describing larvæ, it would prevent much confusion and error.

It is astonishing how loosely these segments are referred to by most authors. Thus Dr. Fitch, after calling the head the first segment in the above description, excludes it in the descriptions of the larvæ of *Dryocampa senatoria and Dryocampa stigma* which immediately follow (Reports 3, 4 and 5, §§ 322 and 323), and speaks of the long anterior horns as proceeding from the *second* segment, whereas, to be consistent, he should have made them proceed from the *third* segment, as Mr. Wm. Saunders has done with *Dryocampa rubicunda* (*Can. Entomologist* II, p. 76). Dr. Packard (Guide etc, p. 271) speaks of the caudal horn of the larvæ of *Sphingidæ* as proceeding from the *last* segment, which it certainly does not, whichever custom be adopted. Westwood (Intr., II,) though his language on page 319 would lead one to suppose that he included the head as the first segment, more often adopts the other rule, as for instance when he refers to the 11th segment in *Mamestra*, etc., (p. 344). Burmeister in his Manual of Entomology evidently excluded the head as a segment, for he refers (p. 35) to the "three first segments of the body following the head," and afterwards (p. 41) speaks in more precise terms of the body consisting of 12 segments.

Strictly speaking, the normal insect larva is composed of 13 segments, and a more or less distinct terminal sub-segment; but in all those larvæ in which the anterior segment is covered by a horny case, so as to form a distinct head, it seems more appropriate to consider this as the head in contradistinction to the twelve articulations of the body. Especially is this the case with Lepidopterous larvæ, which are so plainly marked with a horny head, 12 soft joints and a terminal subjoint; and this plan has been adopted by most of the leading entomologists, including Boisduval, Guenée, Harris, etc.

In my own descriptions I have always adopted this course, so that when I speak of the first joint I mean that immediately following the head. Of late I have adopted the term *joint* because it is shorter and perhaps more strictly accurate than *segment.* I also discard the term *feet,* as often applied to the horny articulate legs, for they are not feet in any sense of the word, but are the true legs of the insect, and the simple term legs or thoracic legs will at once distinguish them from the abdominal an anal prolegs or false legs.

THE LARVA SPINS A WEB.

From the very moment it is born till after the fourth or last moult, this caterpillar spins a web and lives more or less in company; but from the fact that this web is always attached close to the branches and trunks of the trees infested, it is often overlooked, and several writers have falsely declared that it does not spin. At each successive moult all the individuals of a batch collect and huddle together upon a common web for two or three days, and during these periods —though more active than most other caterpillars in this so-called sickness—they are quite sluggish. During the last or fourth moult they very frequently come low down on the trunk of the tree, and, as in the case of the gregarious larvæ of the Hand-maid Moth (*Datana* *ministra)*, which often entirely denude our Black Walnuts, they unwittingly court destruction by collecting in such masses within man's reach.

IT FEEDS BOTH ON ORCHARD AND FOREST TREES.

In the summer of 1867 this insect did great damage in Western New York, where it is falsely called THE "Army-worm." From the fact that Mr. Peter Ferris, of Millville, Orleans county, N. Y., was greatly troubled with it that year in his apple orchard, and that he did not notice any of the same worms on the Oak and Walnut timber of that section, he concluded that his Apple-feeding worms must be different from those feeding on forest trees. In an article signed "F., Orleans county, N. Y.," which appeared in the *Country Gentleman* of July 23d, 1868, the same writer endeavors to prove his Apple-feeding worms distinct by sundry minute characters, as may be seen from the following extract:

> Now I am not an entomologist, but still must be allowed to believe that there are several points, if not "distinctive characters," in which our caterpillar differs from the Tent-caterpillar of the Forest, as described by Dr. Fitch. His larva is of a pale blue color, tinged lower down on each side with greenish-gray. In ours the prevailing color on the back is black; there is a sky-blue stripe on each side but no greenish-gray. Both have the white spots on the back much alike, though perhaps ours are more club shaped, looking to the naked eye nearly the shape of ten-pins. Both have these spots surrounded with black; in ours there is quite a broad black stripe on each side of the spots. This black stripe is more or less filled with fine, crinkled, bright orange lines. In some, these orange lines are so plenty as to be seen plainly without the glass; in others the color to the naked eye is a fine velvet-black. In the larva described by Dr. Fitch there is much less of black and of the fine crinkled lines, which are pale orange-yellow. There is a somewhat broader stripe of the same yellow color, in place of a narrow orange one in ours. The lower yellow stripe may be much alike in both, but what is sky-blue in one is greenish-gray in the other. In both, the head is of a dark bluish color, but in his it is freckled with numerous black dots; in ours, both to the naked eye and under a glass, it is plain. In his "the second segment or neck is edged anteriorly with cream-white, which color is more broad on the sides. The third and fourth segments have each a large black spot on each side." Both the cream white edge and black spots are entirely wanting in our caterpillars.
>
> The habits of the larvæ also appear to be different. According to Harris and Fitch, the Tent-caterpillar of the Forest lives in large societies, under a tent or cob-web-like nest placed against the side of the tree, and comes out to feed on the leaves. Others, as well as myself, have watched our caterpillars and entirely fail to discover that they lived in communities, or in any one place that they went from and returned to. While small, they remain scattered over the smaller branches and on the leaves, and are first seen to begin to get together when about half grown, on some of the higher limbs in the sun. They only collect in large bunches on the trunk and lower limbs; when nearly full grown, and the weather is hot, they get in the shade; and then they never have any web or particular place

they return to, or show any uniformity in the size of the bunches. But they only manage in this way while the leaves last. As soon as one tree is stripped they go to another, and when one orchard is used up leave for another. They are great travelers; on a smooth track, like a hard road or a fence cap-board, they get along quite fast. They do not try to keep together, but each one goes on his own hook. There is very little said about the Tent-caterpillar of the Forest traveling in this way.

Then our larvæ appear decidedly to prefer the leaves of the Apple-tree, and only feed on the leaves of other trees when the former are not to be had. Though I am not prepared to say that they will not feed on Oak, Walnut or Hickory trees, under any circumstances, I have repeatedly found these trees in full leaf when not only Apple trees, but Ash and Basswood trees near by, were entirely stripped. The eggs are sometimes laid on Hard Maple shade trees, but the caterpillars leave these trees as soon as they get much size, evidently in search of food more suitable to their taste. This may be the case in regard to Oak and Walnut trees.

They also select different places for their cocoons. Dr. Fitch says the Tent-caterpillar of the Forest selects a sheltered spot for its cocoon, such as the corner or angle formed by the meeting of two or three sides. In this the cocoon is suspended. Our larva selects one or more leaves on any tree that is convenient. The edges of the leaves are drawn together, forming a shelter in which there is generally one cocoon; though when the space is large, and they are very numerous, there are often two or three cocoons together. The cocoon is not suspended, but fastened to the leaf. They spin their cocoons in the forepart of July, and the moths appear in the latter part of the month. The Tent-caterpillar of the Forest spins its cocoon about the 20th of June, and the moth appears in the forepart of July.

Now I think enough has been given to show that two distinct insects are under consideration, but, being only a farmer, I may be mistaken. I would like to see Dr. Fitch's views on this question. Undoubtedly he has read Dr. Walsh's article on "The Three so-called Army-worms," in the *Practical Entomologist*, and can tell whether our caterpillar is a distinct insect, or only shows the variations that may be expected in the Tent-caterpillar of the Forest.

Now since Dr. Fitch has not, to my knowledge, complied with Mr. Ferris's courteous wish, the labor has devolved upon me. I have taken upwards of 200 specimens from the same batch of Oak-feeding worms, and upon critically examining them, find that Dr. Fitch's description is accurate, and that the differences or variations mentioned by Mr. Ferris arise in every case, either from a misapprehension of Dr. Fitch's meaning, or from variations which may be found in the same brood. The only real difference between the two writers lies in the statement of Dr. Fitch that the worms live under a large cob-web-like nest, and that of Mr. Ferris that they do no such thing. Both statements should have been qualified, and were made without sufficient observation; for though the normal habit of the worms is to collect outside of their nests, I have seen exceptional instances of their collecting within or underneath it, especially when young.

Now it is just barely possible that in Western New York there may be a race of these worms that has taken to feeding on Apple and has lost all appetite or become incapacitated for feeding on forest trees; in other words, that there is a phytophagic variety, or a phytophagic species in process of formation. I could mention several similar occurrences among insects,* and to those who believe in the immutability of species these occurrences are incomprehensible enough; but to those who accept the more modern Darwinian views, and believe that species are slowly being formed to-day, just as they have been for long ages and ages in the past, they are most significant, and exactly what we should expect. But that such a race has yet been formed is rendered highly improbable from the following facts: 1st. It is spoken of both by Dr. Fitch and Dr. Harris as occurring on Oak, and by the latter as also occurring on Walnut, Apple and Cherry in the New England States. Mr. George E. Brackett of Belfast, Maine,† in referring to its ravages in the orchard, states that it also ravaged the forests in the summer of 1867, eating the leaves of most kinds of deciduous trees, though Poplar and Ash seemed to be their favorites. 2nd. I have, in our own State, successfully transferred them from Oak to Apple, and from Apple to Oak, and now have a suite of moths bred from larvæ which were fed half the time on the one and half the time on the other. Given an equal quantity of Oak, Apple, Plum, Peach, Cherry, Walnut, Hickory, Rose, they have invariably seemed to prefer and thrive best on the Apple.

IS IT EVER VERY DESTRUCTIVE?

This question is raised by Dr. Fitch, who, on insufficient grounds, discredited the previous assertion of Abbot, that it "is sometimes so plentiful in Virginia as to strip the oak trees bare." The destruction it caused in some of the Eastern States in 1866 and in 1867, is sufficient to decide this question; but there is every reason to believe that in the South and West its injuries are of still vaster extent. From Mr. John H. Evans of Des Arc, Ark., I learn that it last summer completely stripped the over-cup timber in the overflowed bottoms of that country, and for the past two years it has been quite destructive both to forest and orchard trees, in many parts of Missouri. In the Oak timber these worms prefer trees of the Black Oak group, and will seldom touch the White Oak in bodies, though when scattered among the other kinds, they attack it also.

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*For an account of such insects as are known to have phytophagic varieties or phytophagic species I must refer the reader to Mr. Walsh's papers on the subject in the proceedings of the Entomological Society of Philadelphia for 1864 and 1865. But, as the most familiar and striking examples I will mention, first—the polyphagous black-pencilled larva of *Halesidota tassellata*, Sm. and Abb., found feeding on Oak, Hickory, Elm, Plum and other trees, and the monophagous orange-pencilled larva of *H. Harrisii*, Walsh, found exclusively on Sycamore; the moths from the two being absolutely undistinguishable. Second—the yellow-necked larva of *Datana ministra*, Drury, found on Apple and other trees, and the black-necked larva of the same moth found on Black-walnut and Hickory. Third—the large Butternut and Walnut-feeding form of the common Plum Curculio (*Conotrachelus nenuphar*, Herbst.)

†Amer. Journal of Hort., Sept., 1867.

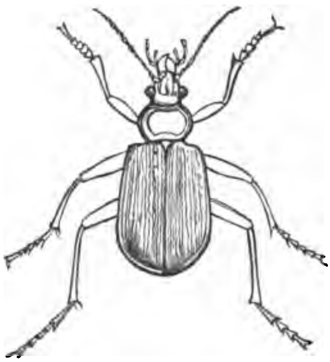
ARTIFICIAL REMEDIES.

From the time they are born till after the third moult these worms will drop and suspend themselves mid-air, if the branch upon which they are feeding be suddenly jarred. Therefore when they have been allowed to multiply in an orchard this habit will suggest various modes of destroying them. Again, as already stated, they can often be slaughtered *en masse* when collected on the trunks during the last moulting period. They will more generally be found on the leeward side of the tree if the wind has been blowing in the same direction for a few days. The cocoons may also be searched for, and many of the moths caught by attracting them towards the light. But pre-eminently the most effective artificial mode of preventing this insect's injuries is to search for and destroy the egg-masses in the winter time when the trees are leafless. Not only is this course the more efficient because it is more easily pursued, and nips the evil in the bud, but for the reason that, in destroying the eggs only, we in a great measure evade killing, and consequently co-operate with, the natural parasites presently to be mentioned, which infest the worms themselves. A pair of pruning shears attached to the end of a pole, and operated by a cord, will be found very useful in clipping off the eggs; or, as recommended by Mr. Ferris, a more simple instrument may be made by fastening a piece of an old scythe to a pole. If the scythe is kept sharp, the twigs may very handily be clipped with this instrument. Tarred bandages, or any of the many remedies used to prevent the female Canker-worm from ascending trees, can only be useful with the Forest Tent-caterpillar when it is intended to temporarily protect an uninfested tree from the straggling worms which may travel from surrounding trees.

NATURAL REMEDIES.

It is always wise to co-operate, whenever we can, with our little friends among the Bugs, and it is consequently very necessary to be acquainted with them. It happens, fortunately, that we have several which aid us in keeping the Tent-caterpillar of the Forest in check, and in the natural forest we must trust entirely to these auxiliaries, as the mechanical means that can profitably be employed in a moderate sized orchard are impracticable in broad extents of timber. Indeed, these cannibals and parasites do their work so effectually that this caterpillar is seldom exceedingly numerous for more than two successive years in one locality, It prevails suddenly in great numbers, and again is scarcely noticed for years, very much as is the case with the true Army-worm. Thus, after attracting such general attention in 1867 in many parts of the East, it has scarcely been noticed since. This is its history everywhere, and we may reasonably hope that in those parts of the West where it has been cutting such a figure the present summer, it will suddenly be so subdued as not to be noticed for some years to come. Its undue increase but combines the assaults of its enemies, until they multiply so as to gain the ascendency. Then, from insufficiency of food these enemies suddenly decrease in numbers, and their natural prey has a chance to increase again. And so it goes on in the "Struggle for Life," and in the great complicated net-work in which every animal organism is involved: a check here and a check there, and no one of all the myriad forms allowed to keep the ascendency beyond a limited time. The most efficient cannibal insects in checking the increase of this Forest Caterpillar, are the larger Ground-beetles belonging to the genus *Colosoma*. These beetles will pounce upon the worms with astonishing greed, and are especially prone to attack them when helplessly collected together during the moulting periods. The Rummaging Ground-beetle (*Colosoma scrutator*, Fabr.), which every one will recognize from the figure (54), is especially fond of them. The most common parasite which occurs abundantly in the West, as well as in the East, and which I have bred from several other caterpillars, is a maggot producing a Tachina-fly, which differs only from the Red-tailed Tachina-fly (*Exorista leucaniæ*, Kirk.), which infests the Army-worm, in lacking the red tail.* The other parasite which infests it in the East, but which I have not yet met with, is a species of *Pimpla* very closely allied to *P. melanocephala*, Brullé, but differing from that species in the head being red and not black.†

[Fig. 54.]



SUMMARY.

The Tent-caterpillar of the Forest differs from the common Orchard Tent-caterpillar principally in its egg-mass being docked off squarely instead of being rounded at each end; in its larva having a row of spots along the back instead of a continuous narrow line, and in its moth having the color between the oblique lines on the front wings as dark or else darker, instead of lighter than the rest of the wing. It feeds on a variety of both forest and orchard trees; makes a web which from its being usually fastened close to the tree is often overlooked; is often very destructive, and is most easily fought in the egg state.

**Exorista leucaniæ*, Kirkpatrick = *E. militaris*, Walsh. I have bred the variety lacking the red at tip of abdomen from larvæ of *Attacus cecropia*, Linn., *Datana ministra*, Drury, *Agrotis inermis*, Riley, and of two undetermined Agrotidians.

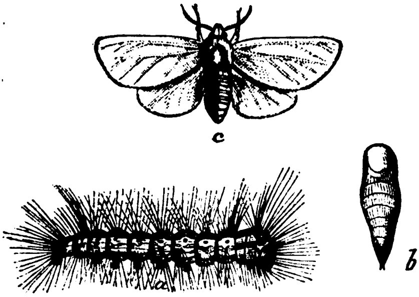
†*Practical Entomologist*, II, p. 114.

THE FALL WEB-WORM—*Hyphantria textor*, Harris.

(Lepidoptera, Arctiidæ.)

With the two preceding caterpillars is often confounded a third which in reality has nothing in common with them, except that it spins a web. The insect I refer to is known by the appropriate name of Fall Web-worm, and whenever we hear accounts of the Tent-caterpillars taking possession of trees and doing great injury in the fall of the year (and we do hear such accounts quite often), we may rest assured that the Fall Web-worm is the culprit and has been mistaken for the Tent-caterpillars, which never appear at that season of the year.

[Fig. 55.]



I do not know how injurious this insect is in the more Southern States, but he who travels in the fall of the year, with an eye to the beauties of the landscape, through any of the Northern and Middle States, especially towards the Atlantic sea-board, will find the beauty fearfully marred by the innumerable webs or nests of this worm. If they are as common as they were last fall, he will very naturally deplore the unsightly appearance of the forests, and feel amazed at the number of these signs of carelessness and slovenliness which occur in the cultivated orchards! The Web-worm is found on a great many kinds of trees, though on some more abundantly than others; but with the exception of the different grape-vines, the evergreens, the sumachs and the Ailanthus, scarcely any tree or shrub seems to come amiss to its voracious appetite. This insect passes the winter in the pupa state under ground and the moth emerges during the month of May or as late as the fore part of June. The female deposits her eggs in a cluster on a leaf, generally near the end of a branch, and these eggs hatch during the months of June, July and August, earlier or later, according to the latitude. Each worm begins spinning the moment it is born, and by their united effort they soon cover the leaf with a web, under which they feed in company, devouring only the pulpy portions of the leaf. As they increase in size they extend their web, but always remain and feed underneath it. When young the worms are pale-yellow with the hairs quite sparse and with two rows of black marks along the body and a black head. When full grown they generally appear pale-yellowish or greenish with a broad dusky stripe along the back and a yellow stripe along the sides, and they are covered with whitish hairs which spring from black and orange-yellow warts. Figure 55, *a*, gives a very good idea of a full grown worm, but the species is very variable both as to depth of coloring and markings.

Both Dr. Harris and Dr. Fitch state that this worm spins its thin cocoon in crevices of bark and similarly sheltered places above ground, but a great many of the specimens which I have reared (and I have bred specimens three different years,) buried themselves and formed their cocoons just under the surface of the ground—thus giving evidence that the same insect will sometimes variously spin up above or below the ground. The chrysalis (Fig. 55, *b*) is of a very dark brown color, glabrous and polished and faintly punctured, and is characterized by swelling or bulging about the middle. The moth (Fig. 55, *c*) is white with a very slight fulvous shade; it has immaculate wings, but the front thighs are tawny-yellow and the feet blackish: in some the tawny thighs have a large black spot, while the shanks on the upper surface are rufous; in many all the thighs are tawny-yellow, while in others they have scarcely any color. One bred specimen in my cabinet even has two tolerably distinct spots on each front wing—one at base of fork on the costal nerve, and one just within the second furcation of the median nerve.

During the summer and fall of 1870 this worm was unprecedently numerous, not only in our own State but all over the country, and, as was remarked by others as well as myself, it hatched out much earlier than usual; for the first webs were noticed around St. Louis by the middle of June. It has always been supposed to be single-brooded, and in the New England States it never does perhaps produce more than one brood each year; but though such may be its normal habit, even in the latitude of St. Louis, yet there is good evidence that it sometimes produces two broods in that latitude, and in all probability does so constantly still further south. There appeared to be two broods with us the present year, and Mr. J. R. Muhleman, of Woodburn, Illinois, informed me that on August 5th, he had a second brood of worms, the first brood having appeared in June on Pear and Osage Orange. He did not, however, breed one generation from the other, and until this is done during the same year, we cannot say with absolute certainty that the species is two-brooded, for the disparity in time of appearance can be accounted for in other ways. The climate of the Central portion of our State is intermediate between that of the more Northern and the more Southern States, but the fauno partakes more of the character of the latter; and our summers are so variable in their duration and in their general intensity, that our insects show a great variability in their habits. It is for this reason that I find it very difficult to draw the rigid lines that many of our New England writers have done when treating of a particular insect, and it is for this reason that we frequently find insects, normally single-brooded there, often producing two broods a year here.

With us the Fall Web-worm appears to be most partial to the hickories and to the Black walnut, and least so to the oaks; but I have found scarcely any tree or shrub exempt from its attacks except those already mentioned, and it is even said to feed on the Hop-Plantain, Bean, Sunflower, and many other herbaceous plants.

From the foregoing account it will at once be seen how widely this Fall Web-worm really differs from the Tent-caterpillars. It hibernates in the pupa state, they in the egg state; it appears mostly in the fall, they mostly in the spring; its moth is pure white, theirs reddish brown; its eggs are deposited on a leaf, and hatch before the leaf falls, theirs are deposited around a twig, because they have to pass the winter and would get lost with the leaves if deposited upon them; it feeds solely on the parenchyma of the leaf under its web, they devour the whole leaf outside of their tent; and on account of these differences, we cannot employ the preventive measures against it which we take against them.

REMEDIES.

As, therefore, nothing can be done to materially affect this insect during the winter, we must do all the fighting when the worms first hatch. Their web soon betrays them, and the twig or branch containing it may be pruned off in the same manner described for the Tent-caterpillars. As the worms are always under the tent, the operation in this case can be performed at any time of the day without the risk of missing any wanderers.

HYPHANTRIA TEXTOR—*Larva*—(Fig. 55, *a*) Ground-color greenish-yellow. Dorsum velvety-black, with a narrow median pale line on thoracic joints. Sides speckled with black, except along subdorsal and stigmatal lines, where longitudinal yellow patches are left clear. Venter dusky or smoky-brown. Head shiny black with labrum and antennæ white. Thoracic legs black; prolegs long and narrow, smoky-black with faint orange extremities. Covered with long straight hairs, longest on joints 2, 3, 11 and 12. These hairs are either dirty white with a few black ones interspersed, or of a more uniform reddish-brown. They spring in bundles from around large warts situated as follows on each joint; 4 which are black and dorsal, arranged in a trapezoid, the anterior pair being the smaller; and four which are orange on each side, and arranged in a transverse row in the middle of the joint. Stigmata light yellow. Average length, 1.10 inches.

Varies considerably, in some the black predominating, in others the yellow. Those found on hickories are usually the darkest. When newly hatched it is pale yellow with two longitudinal rows of black marks and a black head.

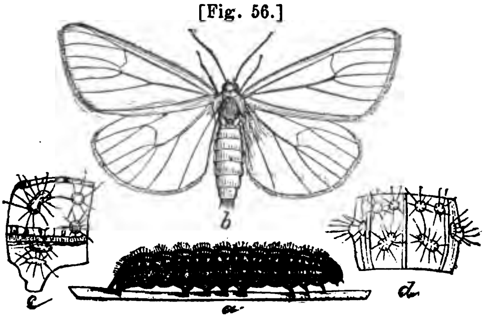
Described from numerous specimens.

THE BLUE-SPANGLED PEACH WORM—*Callimorpha fulvicosta*, Clem.

(Lepidoptera, Arctiidæ.)

In examining apple trees, but more especially peach trees, during winter or early spring, we often come across little black worms, covered with short, stiff, sprangling hairs, and studded with minute blue spots, sheltering under the loose bark. As soon as the leaves put out, these worms issue from their winter retreat and commence feeding. They

[Fig. 56.]



grow apace and by the end of April have usually acquired their full size, when they present the appearance of Figure 56, *a*; *c* showing an enlarged side section of one of the principal joints, and *d* a back view of the same. The color is now velvety black above, and pale bluish, speckled with black below; there is a deep orange line along the back, and a more distinct wavy and broken one along each side: the warts, illustrated in the enlarged sections are steel-blue and granulated, and their irregularities, as they catch and reflect the light, look like minute pale blue diamonds, the whole body, upon casually glancing at it, appearing studded with these blue points. This worm spins a slight cocoon of white silk in any sheltered place it can find, and changes to a chrysalis of a purple-brown color, finely and thinly punctured and terminating in a horizontally flattened plate, which is furnished with numerous yellowish-brown curled bristles. The moth (Fig. 56, *b*) issues from this chrysalis during the fore part of June. It is a very plainly marked species, being either milk-white or cream-colored, with the head, collar, basal and apical joints of the abdomen above, and the whole body, legs, and anterior margins of the wings fulvous or dull orange.* It was described in 1860 by Dr. Brackenridge Clemens under the name of *Hypercompa fulvicosta*† but is now properly referred to the genus *Callimorpha*. It may be known in English as the Cream Callimorpha as it is disguished from all other moths by its unspotted creamy appearance.‡ This worm is found more commonly on

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***Callimorpha vestalis*, Packard (Proc. Ent. Soc. Phil. III, p. 108), must be considered as a synonym of *fulvicosta*, for Dr. Packard has certainly given no characters that should be considered specific. To show on what grounds the new species is founded I will quote in full the original description of *fulvicosta* and afterwards that of the so-called *vestalis*:

C. fulvicosta, Clem.—"White. Palpi yellow orange, tips blackish. Head prothorax, the anterior edge of the fore wings, especially beneath, yellow-orange; sometimes the costa of the fore wings is dark brownish. Breast and legs yellow orange, the middle and fore tibiæ and tarsi blackish. Abdomen tipped with yellowish orange.
"Illinois. From Robt. Kennicott."

C. vestalis, Pack.—"♂ and ♀ pure immaculate milk-white, ♀ white. Tips of the palpi brown. Head and prothorax, basal half of the patagia and costa of both wings above and beneath yellowish. The legs are also yellow beneath. The abdomen is white and unspotted. Antennæ brown. Body ♂ .65, ♀ .65. Exp. wings ♂ 1.70, ♀ 1.70 inch.
"Middle Atlantic States (Coll. Ent. Soc. Phil., through A. R. Grote."

Now, comparing the descriptions, *vestalis* differs in no other respect from *fulvicosta*, than in the legs being yellow beneath instead of having the middle and fore tibiæ blackish as described by Clemens. Three bred specimens in my possession differ in this trifling character, and though Dr. Packard says that his species differs *remarkably* [*!!*] from the other in being pure white and of smaller size, yet Dr. Clemens gives no measurements and there are specimens in my own cabinet and in Mr. Walsh's of all shades of white to cream color and some of them fully as small as the measurements above quoted. Moreover I have a specimen marked *vestalis*, kindly sent me by my friend Cresson of the Am. Entomological Society, and while in Philadelphia last fall I examined all the specimens marked or said to be *vestalis* without finding any distinguishing characters at all. If a new species is to be made out of such trifling characters in the face of the fact that the species of the genus *Callimorpha* are very prone to vary, and that twenty times as much variation is found in hundreds of other species of Lepidoptera, what is the science of entomology to come to?

†Proc. Acad. Nat. Sci. Phil., 1860, p. 536.

‡The only insect which very closely resembles it is a pale variety of a moth known as the Egle (*Euchætes egle*, Harr.) whose beautiful larva is tolerably common on our milkweeds. This last however may always be distinguished by the feathered antennæ of the male, the different shaped wings and the deep orange and black spotted abdomen.

the Peach than on any other tree, and as it appears very early in the season and commences to feed on the young leaves before they are fully expanded, it does considerable damage when numerous. I have been acquainted with the worm for several years past but its natural history was unknown till last summer when Dr. LeBaron and myself simultaneously bred the moth from peach-leaf feeding larvæ, so that its history is now given for the first time. Figures of the larva were given in the *Prairie Farmer* last summer by Dr. LeBaron who was misled by Dr. Hull into the belief that they were the Tent-caterpillar of the Forest already described. Two years ago I found this Blue-spangled worm tolerably common in the peach orchard of Mr. E. J. Ayres of Villa Ridge, Ills., and he says that he destroyed over a thousand of them last spring. In this State I have frequently met with it but it is by no means common. Hand picking will easily keep it in check.

CALLIMORPHA FULVICOSTA, Clem.—*Larva* (Fig. 56, *a*)—Color velvety-black above, pale bluish-gray speckled with black below. A deep orange medio-dorsal line (usually obsolete towards each end) and a more distinct, wavy, broken, yellow stigmatal line, with a less distinct coincident pale line below it. Covered with large highly polished, roughened, deep steel-blue warts, the irregularities of which as they catch and reflect the light, look like pale blue diamonds. Closely examined these warts are found to be covered with small elevations each of which furnishes a short stiff yellow hair, these hairs radiating in all directions around the warts, which are placed as follows:—Joint 1 with an anterior transverse row of 8 and a posterior dorsal row of 4; joints 2 and 3 each with a transverse row of 8 across the middle; joints 4—11 inclusive, each with 4 circular ones anteriorly, and 2 irregular ones posteriorly on dorsum (Fig. 56 *d*, each of the last evidently formed by the blending of two), and 2 on each side near the middle of joint (Fig. 56 *e*). Joint 12 with 2 that are irregular, on the back, and 1 that is circular, on each side. Anal shield formed of one large irregular wart. In addition to these there is a narrow subventral wart each side, and 2 small ventral ones on the legless joints. Head polished black with a few black hairs. Thoracic legs polished black, but pale at the joints inside: prolegs black outside, flesh-colored within and at extremities. Stigmata not perceptible. Largest in the middle of body. Average length 0.90, greatest diameter 0.15 inch.

Described from 6 peach-feeding specimens. Alcoholic specimens do not reflect the pale blue points.

The larvæ of our different *Callimorphas* seem to bear a very close resemblance to each other. I have bred *C. clymene*, Hubner, from a larva found full grown on oak (tho' whether it fed on oak I did not ascertain) which so resembled that of *fulvicosta* that I fully expected it would produce nothing else. The only difference noticeable was that it was very bright colored, with the medio-dorsal line very clear and distinct. Mr. Wm. Saunders has reared *C. LeContei* from larvæ feeding on Horse Gentian (*Triosteum perfoliatum*), and from his description of the larva* it differs principally from the above in lacking the blue reflections and in having a pale dotted subdorsal line.

THE ASH-GRAY PINION—*Xylina cinerea*, N. sp.

(Lepidoptera, Xylinidæ).

There is a pale green worm with cream-colored spots and a broad cream-colored lateral band, which I have for several years known to

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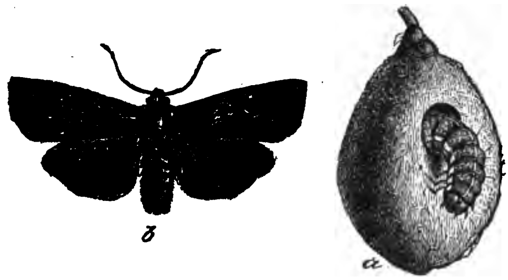
* *Canadian Entomologist* I, p. 20.

[Fig. 57.]



be common on the Apple, Poplar, Hickory and some other trees, the leaves of which it devours, but which last summer attracted unusual attention by its being frequently found boring into apples and peaches, and as I also commonly found it hiding in and feeding upon one of our large oak-apples (the *spongifica*) we may conclude that it is a very general feeder and that it is fond of boring.

This worm (Fig. 57, *a*) is found during the months of May and June and when full grown burrows beneath the surface of the ground where it forms a very thin cocoon of filmy silk with the earth adhering to it on the outside. It changes to a mahogony-brown chrysalis and generally issues as a moth during the September or October following, though in northern Illinois I have known it to remain in the chrysalis state through the winter and not issue as a moth till April.

The moth (Fig 57, *a*) varies considerably in its appearance, but is characterized by the cold ash-gray appearance of the front wings which are variegated with darker gray as in the figure. It is an undescribed species and belongs to a genus (*Xylina*) which is easily recognized by the long narrow almost rectangular wings, the very square thorax which is often furnished behind the collar with a bifid crest, and the rectangular and flattened abdomen. The wings are folded in repose and appear almost parallel and like a flattened roof—giving the insect an elongate appearance.

XYLINA CINEREA, N. Sp.—*Larva* (Fig. 57, *a*.) Length when full grown 1.20—1.30 inches, color shiny silvery-green on the back, darker below. A medio-dorsal cream-colored stripe; a subdorsal one represented by 3 or 4 irregularly shaped spots on each joint. A broad deep cream-colored stigmatal line, with a few green dints in it, extending to anal prolegs. Four slightly elevated cream-colored spots, encircled by a ring of rather darker green than the body, in the dorsal space, and in the subdorsal space there are four or more similar but smaller spots. Venter glaucous-gray. Head as large as joint 1, free, glassy-green with white mottlings at sides and top, and pearly-white lips. Thoracic legs whitish. Prolegs concolorous with venter. When young the body is darker and the markings paler.—Described from two living specimens.

Imago (Fig. 57, *b*)—*Front wings*, with the ground-color pale cinereous shaded and marked either with light brown, having a faint purplish tint, or with darker brown, having a similar reflection, or with a colder grayish-brown with the faintest moss-green reflection: in the first two cases the dark color either blends and suffuses with the ground-color so as to give the wing a nearly uniform and smooth appearance, or else contrasts sufficiently to bring out all the marks distinct; in the latter case (two specimens) the markings are very distinct and the ground color is whiter and more irrorate. In the well marked specimens the usual lines are readily distinguished, the basal half line, transverse anterior and transverse posterior being quite wavy, pale, and bordered each side with a dark shade, the median shade dark and well defined and the subterminal line, though sometimes pale near costa, forming a series of dark angular spots: in the more uniform specimens these lines are barely distinguishable and perhaps the most constant is the sub-terminal which most often takes the form of a series of dark angular spots: the ordinary spots have a pale inner and a more or less distinct dark outer annulation; the orbicular is larger than the reniform and is sufficiently double to take on the form of an 8, the upper part of which is always largest and with the interior space paler than the general surface, while that of the lower part is either concolorous or darker; the form is, however, quite irregular and differs sometimes in the two wings of the same species: the reniform spot is generally well defined, and is either darker, or has a tinge of reddish-brown, interiorly: at the base of the wing is a more or less distinct pale space occupying the upper half, and bordered below by a brown line which is straight about half its length and then extends upwards and outwards towards transverse anterior. A tolerably distinct terminal line, with the fringes dark. In taking a general view of the varying specimens this pale basal space, the pale upper part of the orbicular and the dark subterminal line, seem to be the most constant characters of the species. *Hind wings* gray-brown inclining to cinnamon-brown, with the posterior border but slightly darker and the fringe paler. Under surface quite uniform, that of front wings being nacreous gray with a faint discal spot and with a narrow costal and broad terminal border of pale fulvous, dusted with purple-gray; the hind wings of this last color with the lunule and line distinct. *Head* nearly entire, though the quadrifid arrangement of the hairs is traceable; palpi hairy throughout. *Thorax* quite square, of same color as primaries and with the collar bordered behind with brown and sometimes the edges of the tegulæ similarly bordered. *Abdomen* of same color as hind wings with lateral tufts, and cut off squarely at apex. Expanse 1.32—1.82 inches.

Described from 3 specimens fed on grape-vine, 2 on peaches and 1 on *Cercis canadensis.* Other captured specimens examined.

This species is the analogue of, and very closely resembles the European *Xylina conformis*, which is known under various synonyms. A specimen sent to Mr. P. C. Zeller of Stettin, Prussia, was, however, pronounced distinct. The well-marked irrorate form still more closely resembles Guenée's *cinerosa* found in Switzerland, and which he himself thinks may prove to be a variety of *conformis.* The more I study the species of the NOCTUIDÆ as they occur in nature, the more I am struck with their great variability, and there can be no doubt that many of the so-called species will turn out to be but varieties when we better understand them. In this large family none but the more strikingly marked species should ever be described without an accompanying description of their preparatory states and of their principal variations. I am unacquainted with any of Walker's species except *subcostalis* which is very different, and if this should prove to be a synonym of any of them, the fault must be laid to the difficulty under which the naturalist in the Western States labors for want of proper libraries to refer to. It differs essentially from Grote's *Bethunei* and *capax* as described and illustrated in Volume I of the Transactions of the American Entomological Society. I am informed by Mr. A. Lintner of Albany, N. Y., that Dr. A. Speyer of Rhoden, Furtsenthum Walldeck, Prussia, who gives much attention to the Noctuidæ, has it marked *Celæna oblonga* in his MS., but the insect evidently does not belong to that genus, and as the German pronunciation of *Xylina* much resembles the English pronunciation of *Celæna,* the reference to the latter, is doubtless due to a verbal misunderstanding.

BENEFICIAL INSECTS.

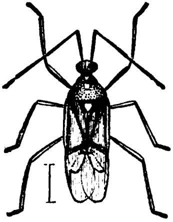
It is not often that there will be much to say in this Department, as most of the beneficial insects are treated of in connection with the injurious species upon which they prey. But the following little fellow is so important to the grape-grower that it should be recognized by every vineyardist in the State, and cherished as the very apple of his eye:

THE GLASSY-WINGED SOLDIER-BUG—*Campyloneura vitripennis*, Say.

A NEW FRIEND TO THE GRAPE-GROWER.

This is the bug; and a pretty little thing it is too! Take a good look at the figure and remember that the hair-line at the side represents the natural size.

[Fig. 58.]

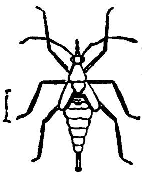


There are perhaps no insects more dreaded by the grape-grower than the different species of leaf-hoppers which sap up the substance of the leaves of the Vine; but as they will be treated of, in all probability, in my next Report, we will pass them over for the present.

No parasitic or cannibal insect has ever been known to prey upon these leaf-hoppers before, but last September, while in the vineyard of Dr. C. W. Spaulding, at Rose Hill, on the Pacific railroad, I discovered that this Glassy-winged Soldier-bug was preying upon them. The leaves were actually covered on the underside with the dead carcasses of the leaf-hoppers, which, in their death-struggle, had firmly attached themselves, and hung thickly, with wings extended and body sucked dry—dead proof of the surprising thoroughness with which their mortal foe had done its work of slaughter. On a single leaf not so large as a man's hand a half hundred of these skeleton leaf-hoppers could be counted, and though this number was above the average, there were few leaves that did not show quite a number. To use Dr. Spaulding's language, " the sight was enough to gladden the heart of any grape-grower, who had long looked upon the leaf-hopper as a permanent evil against which he could not successfully contend."

Moving about among the leaves our little Soldier-bug* was often seen in its pretty full dress uniform, but far more commonly disguised in its larval or pupal coat; for it is only when full grown and full fledged that it presents the appearance of the first figure. The larva and pupa both have an opaque, mealy, bluish-white appearance, and the latter differs only from the former in the more conspicuous wing-stubs, which project so as to give it a somewhat diamond shaped outline (Fig. 59.) It is during these immature, and less conspicuous stages that this insect doubtless does most of its work, for in common with the rest of the true Bugs (*Heteroptera*) it is active and feeds during its whole life, from the time it hatches from the egg till it dies of old age.

[Fig. 59.]



When I first saw the hosts of leaf-hoppers so mercilessly stabbed, I was at considerable loss to understand what animal could be so wary and dexterous as to surprise insects so shy and active, and with such wonderful jumping powers as the leaf-hoppers possess, and I could not rest sure that it was our little Glassy-winged Soldier-bug till I had enclosed specimens in a bottle with living leaf-hoppers, and found the latter dead next day. Like many other animals of prey, it can move actively when necessary, but no doubt prefers to surprise its victims by stealth, assisted perhaps by its colors which resemble those of the leaf-hoppers themselves.

The more common color of this insect is pale greenish-yellow. The antennæ are brown with the basal joint and sometimes part of the second joint blood-red. The head and thorax are pale yellow with a slight tinge of pink, and the eyes, neck, and front part of the thorax, except a pale line on the back, are jet black in high contrast. The scutel is pale yellow or white, and black at base, and the upper wings (hemelytra) are beautifully transparent with a rose-colored cross band and a dusky curved line. The species is a very variable one, however, being dichromous or double-colored, some varieties possessing much more brown than others, and having no rose-color at all. In a variety kindly sent me by Mr. P. R. Uhler, of Baltimore, Maryland, the antennæ are pale, and there is no black on the thorax in front, but a large brown patch behind; there is also a large brown patch each side of the scutel, and the rosy transverse band on the wings is quite brown.

Now this insect is commonly found by collectors in the fall of the year on different kinds of Oak, but no one ever heard before of its

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*I have preferred to apply this popular term to this species, because its black, white and red marks, and its war-like propensities suggest something of the sort; and though the term is more strictly and correctly applied to larger cannibal bugs belonging to the genus *Arma*, yet it is not inappropriate here, and will appeal to the popular mind far more readily than the generic name *Campyloneura*, or the English rendition of it, curved-nerve.

attacking the leaf-hoppers of the Grape-vine, and it certainly could not have done so in past years to the extent that it did at Rose Hill last fall, without its work having been noticed. I have been through vineyards by the hundred in the fall of the year, and never before noticed such work. How are we then to account for its sudden appearance in such force in the vineyard of Dr. Spaulding? To my mind it is an excellent illustration of an insect acquiring a new habit. Some individual or individuals wandering from the oaks and from whatever food they there subsisted upon, came upon Dr. Spaulding's vineyard and found the leaf-hoppers of the Vine to their taste. Their food being abundant, they soon multiplied, so as to make their work appreciable, and commenced to spread from one vineyard to another. The facts in the case would support such a theory, for the bugs and their slaughtered victims were found in diminishing numbers in the vineyards in the immediate neighborhood until at the distance of three miles, no sign of either could be found. Consequently, though our little cannibal friend occurs sparingly throughout the country in the native timber, it is found in the cultivated vineyard in a limited district only, so far as we now know. But there is no reason why the field of its operations in the vineyard should not in time become co-extensive with that of the troublesome leaf-hoppers; and with our present mail facilities we can materially help to make it so by artificially introducing a few dozen of the living bugs from one vineyard to another.

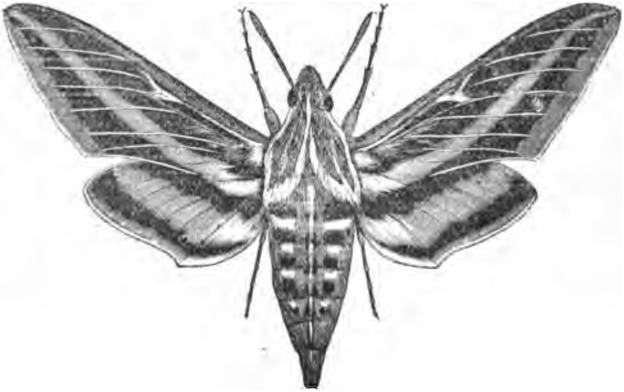
This species was first described by Say as *Capsus vitripennis*. The *Phytocoridæ*, as the name indicates, have all been hitherto considered as plant-feeders, and at first the species above considered would appear to be an exception to the unity of habit in the family. But Mr. Uhler informs me that his investigations of the elongated forms of many of the recently established genera have taught him that the affinities of many of them are largely with the *Reduviidæ* through *Anthocoridæ*; for he has often found them in places where small caterpillars were numerous; among the larvæ of *Tingidæ*, and has even caught them in the act of sucking the juices of plant-lice.

INNOXIOUS INSECTS.

THE WHITE-LINED MORNING SPHINX—*Deilephila lineata,* Fabr.

(Lepidoptera, Sphingidæ.)

[Fig. 60.]



The beautiful moth which heads this chapter is quite common in the State of Missouri, and has upon several occasions been sent to me for identification. Almost every one must have been struck with the great resemblance which it bears to a humming bird, as, of a summer's evening, it flits rapidly from plant to plant in the garden, and ever and anon hovers noiselessly over some particular flower, and stretches forth its long tongue to sip the sweet nectar which that flower contains.

Few persons are, however, aware what this beautiful moth looks like, or what it feeds upon, in the caterpillar state; wherefore this brief account of it.

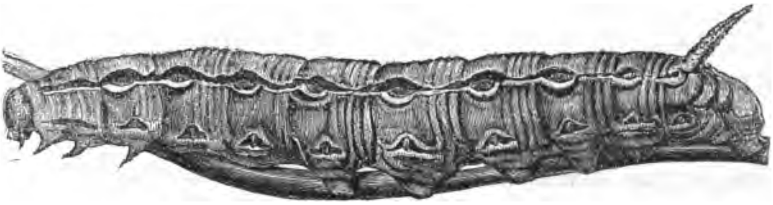
The very great diversity of form and habits to be found amongst the larvæ of our butterflies and moths, has much to do with the interest which attaches to the study of these masked forms. I am moved to admiration and wonder as thoroughly to-day as in early boyhood, every time I contemplate that within each of these varied and fantastic caterpillars—these creeping and groveling "worms"—is locked up the future butterfly, or moth, which is destined, fairy-like, to ride the air on its gauzy wings, so totally unlike its former self. Verily the metamorphoses of the lower animals must prove a never-failing source of joy and felicity to those who have learned to open the pages of the great Book of Nature!

But beyond the general satisfaction experienced in studying these transient forms, there will be found ample food for the philosophic mind in the larval variations to be met with in the same species. Some vary according to the character of their food-plant, and the study of these variations—of phytophagic varieties and phytophagic species—must ever prove interesting as well as important, by throwing light on the question of the origin of species. Some (*e. g.* the common Yellow Bear, Fig. 28, *a,* p. 68) vary very much without regard to food-plant. Our Sphinx larvæ, more particularly, are subject to these variations, and it is for this reason that larval characters alone, unaccompanied by those of the perfect insect, are of so little value in classification.

The White-lined Morning Sphinx (Fig. 60) presents one of the most striking cases of larval variation, as may be seen by comparing the light form of Figure 61 with the dark form of Figure 62. In the summer of 1863 I took both these forms on the same plant, and have repeatedly met with them since; but the moths bred from them show no differences whatever.

This beautiful moth is called by Harris the White-lined Morning Sphinx, though its generic name means "Evening Friend." It is distinguished principally by its roseate under-wings, and by a broad, pale band running from the apex to the base of the dark-olive front wings.

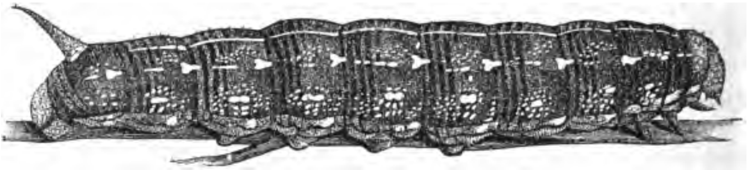
[Fig. 61.]



The larva feeds upon purslane, turnip, buckwheat, watermelon, and even apple and grape leaves, upon any of which it may be found in the month of July. It descends into the ground and, within a smooth cavity, changes into a light brown chrysalis, from which the moth emerges during the month of September.

The most common form of this larva is that given at Figure 61; its color is yellowish-green, with a prominent subdorsal row of elliptical spots, each spot consisting of two curved black lines, inclosing superiorly a bright crimson space, and inferiorly a pale yellow line—the whole row of spots connected by a pale yellow stripe, edged above with black. In some specimens these eye-like spots are disconnected, and the space between the black crescents is of a uniform cream-yellow. The breathing-holes are either surrounded with black, or with black edged with yellow. The other form is black, and characterized chiefly by a yellow line along the back, and a series of pale yellow spots and darker yellow dots, as represented in the illustration (Fig. 62). Even this dark form is subject to great variation, some specimens entirely lacking the line along the back, and having the spots of different shape.

[Fig. 62.]



This insect has a wide range, as it occurs in the West Indies, Mexico and Canada, as well as throughout the United States. Feeding, as it does, principally on plants of but little value, and being very commonly attacked by the larva of a Tachina-fly, this insect has never become sufficiently common to be classed as injurious. The Tachina-fly which so commonly infests it, is readily distinguished from the other more common form by the abdomen, which is bright rufous with the exception of a broad dorsal stripe which is dark.

TWO OF OUR COMMON BUTTERFLIES.

THEIR NATURAL HISTORY; WITH SOME GENERAL REMARKS ON TRANSFORMATION AND PROTECTIVE IMITATION AS ILLUSTRATED BY THEM.

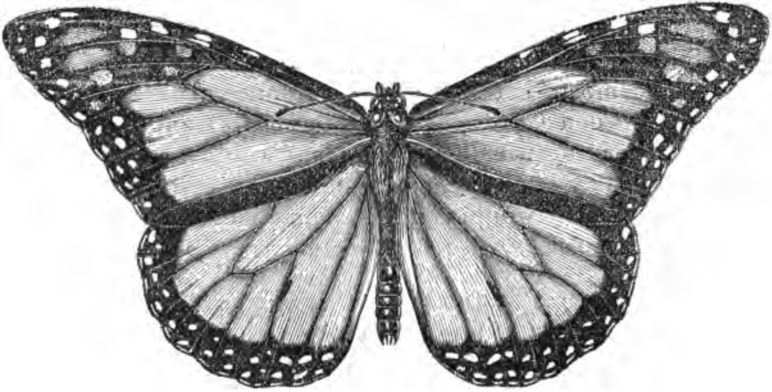
In the following pages I propose to give the complete natural history of two of our commonest butterflies, and to close with such philosophical thoughts as the subject warrants. I do so the more willingly as many of the facts are published for the first time; for notwithstanding the butterflies are so common, their complete natural history has hitherto been unknown.

THE ARCHIPPUS BUTTERFLY—*Danais archippus*,[*] Fabr.

(Lepidoptera, Danaidæ.)

ITS NATURAL HISTORY.

[Fig. 63.]



> "What more felicitie can fall to creature
> Than to enjoy delight with libertie,
> And to be lord of all the workes of Nature,
> To raine in th' aire from earth to highest skie,
> To feed on flowres and weeds of glorious feature."
> *The Fate of the Butterfly*—Spenser.

This beautiful butterfly, like most of the species of the family to which it belongs, enjoys a wide range, occurring in the more northern of the States and in Upper Canada and extending into South America, where, according to Mr. Bates, it is common throughout the region of the Lower Amazons.[†] In the Mississippi Valley it is one of our most common species. The family to which it belongs is distinguished by the front legs being spurious or abortive; by the large cell in the centre of each wing being closed, and by the existence of a small nervule originating at the base of the front wing just below the lower or sub-median nerve, and joining that nerve a short distance from its base.[‡] This nervule is so covered with scales that it is hardly visible till they are removed. In the genus *Danais* the sexes are readily distinguished by the male having a small horny excrescence near the disk of the hind wing, close to, or upon the fourth nerve. This excrescence or tubercle is faintly shown in the above figure, which represents the male, and it is entirely lacking in the female. The color of the Archippus butterfly is of a bright orange-red, marked with black and cream-color as in the figure—the underside being similarly marked but paler, that of the hind wings being bright fulvous. The species feeds upon most of the different kinds of Milk-weed or Silk-weed (*Asclepias*), and also upon Dogbane (*Apocynum*), according to some authors. It shows a wonderful dislike, however, to the Poke Milk-weed (*Asclepias phytolaccoides*), and I was surprised to find that larvæ furnished with this plant would wander about their breeding cages day after day, and would eventually die rather than touch it, though they would eagerly commence devouring the leaves of either *A. tuberosa*, *curassavica*, *cornuti* or *purpurascens* as soon as offered to them.

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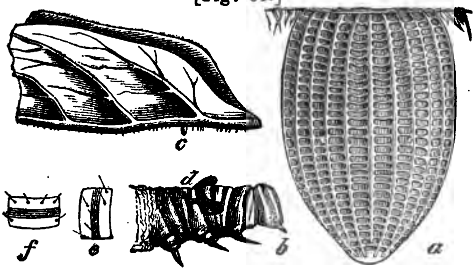
[*] Some late writers use the specific name *erippus* of Cramer, because it seems to have the priority. I have not all the works of the old authors to refer to, but Mr. Sanborn, of Boston, has been kind enough to refer to them for me, and he writes that *erippus* was first applied by Cramer to the ♀ in 1775, and *plexippus* to the ♂ by the same author in 1780. Fabricius published his name of *archippus* in 1793, and the name had already been applied by Cramer to the Disippus butterfly. Accordingly Cramer's *erippus* has the priority; but as this insect has been very generally known by the name which Fabricius gave it, among entomological writers, and as it has become familiar to the popular ear, I prefer to retain it—especially since it is no longer applied to the Disippus butterfly.

[†] Trans. Linnæan Soc., Vol. XXIII, p. 516.

[‡] Mr. Bates in a note to the paper already referred to, (p. 497,) gives this as a constant and excellent character discovered by Dr. C. Felder, of Vienna, and describes it as "a small nervule at the base of the fore-wing median nervure which anastomoses with the median a short distance from its origin." I have no means of referring to Dr. Felder's original article, and cannot say whether he is correctly quoted; but in the two N. A. species of the genus (*D. archippus* and *berenice*) this nervule originates below and anastomoses with sub-median nerve.

The butterflies hibernate, though whether any but the impregnated females survive until the Milk-weeds commence to grow is not definitely ascertained. They commence depositing eggs in the latitude of St. Louis during the fore part of May. Some of the earliest developed butterflies from these eggs begin to appear about the middle of June and others continue to appear for several weeks. These lay eggs again, and the butterflies abound a second time in October. Thus there are two broods each year, and though the first brood of larvæ are hatched more uniformly and within a more limited time than the second, the two broods yet connect by late individuals of the first and early individuals of the second, and the caterpillars may be found at almost any time from May to October, but are especially abundant during late summer and early fall.

[Fig. 64.]



The egg (Fig. 64, *a*, magnified; *c*, natural size) is invariably deposited on the under side of a leaf, and is conical and delicately reticulate with longitudinal ribs, and fine transverse striæ. It is yellowish when first deposited but becomes gray as the embryo within develops.

Description of Egg.—Length 0.05; greatest diameter 0.03 inches. Conical, slightly narrower at base than in middle, and generally slightly contracted towards apex. Color pale cream-yellow; opaque, smooth; the shell but slightly polished and rather soft. About 22 longitudinal narrow carinate ribs, usually regular and single, though occasionally one gives forth a branch; interstices crossed by about 30 very fine transverse striæ, often subobsolete. Apex smooth. Slightly and singly attached to the underside of leaf.

Described from numerous specimens.

It is a little singular that this egg has not previously been described. It is very easily found, and I had no difficulty in obtaining great numbers last summer, though I owe the first one ever obtained to the sharp eyes of Miss M. E. Murtfeldt, of Kirkwood, a lady who takes much interest in Entomology, and is an excellent observer. It were greatly to be wished that more of our ladies would interest themselves in such studies, for we have altogether too few Madam Merians.

In about five days after deposition, the egg hatches, and the young larva as soon as hatched usually turns round and devours its egg-shell; a custom very prevalent with young caterpillars. At this stage it differs considerably from the mature larva; it is perfectly cylindrical, about 0.12 inch long and much of a thickness throughout. The head is jet black and polished; the color of the body is pale greenish-white with the anterior and posterior horns showing as mere black conical points, and with two transverse-oval black warts, nearer together, on the first joint. It is covered with minute black bristles, arising from still more minute warts, six on the back and placed four in a row on the anterior portion and one each side on the posterior portion of each joint, (Fig. 64, *f*); and three on each side, one in the middle of the joint, and two which are substigmatal, posteriorly, (Fig. 64, *e*.) There is a sub-triangular black spot on the anal flap, the legs are alternately black and white and the stigmata are made plainly visible by a pale shade surrounding them. When the young worm is three or four days old, a dusky band appears across the middle of each joint; and by the fifth or sixth day it spins a carpet of silk upon the leaf, and prepares for its first moult. After the first moult the anterior horns are as long as the thoracic legs, the posterior ones being somewhat shorter; the characteristic black stripes show quite distinctly, but the white and yellow stripes more faintly. After this it undergoes but slight change in appearance, except that the colors become brighter and that at each successive moult the horns become relatively longer. There are but three moults.* and the intervals between them are short, as the worms frequently acquire their full growth within three weeks from hatching.

Some persons may be curious to know how the larva acquires longer horns at each moult. The explanation is simple. During each period of growth the skin which is to serve for the next period is forming and perfecting under that which at the the time serves the worm. Upon this inner skin and beneath the outer one, the horns are also developing, and when the outer skin has become useless and the worm, after a short period of rest and fasting, bursts it near the head and works it off, the old horns go with the old skin and the new ones appear as mere stubs. The new skin is now very fresh and moist, and no sooner is the old skin off than these soft stubs begin to swell, and it is then easily seen how wonderfully the long horns have been folded up and curled over and between the wrinkles of h body so as not to impede the casting of the skin. At Figure 64, *b*, I have given a somewhat enlarged view of a worm just in the act of casting its last skin in order to show (at *d*) how the flexible horns were folded. They unbend of their own accord, though the worm often helps to straighten them out by cunningly turning its head and drawing them over the surface of the leaf.

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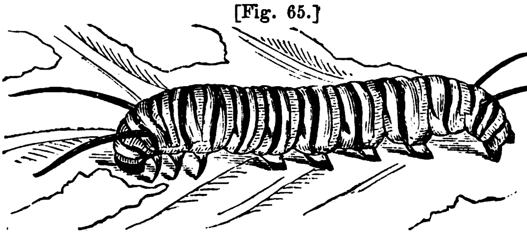
*I do not include the last moult by which the larva is transformed to the chrysalis. Some persons in counting the different moults that larvæ pass through, are content with counting the heads that are shed. Whenever this method is relied on it should be borne in mind that the heads really increase in size between each moult, though not in proportion to the increase of body. Thus, in the present species the first head is considerably larger when shed than it was when the larva hatched, and though appearing uniformly black when hatched, it shows the usual white marks more or less distinctly when shed.

[Fig. 65.]

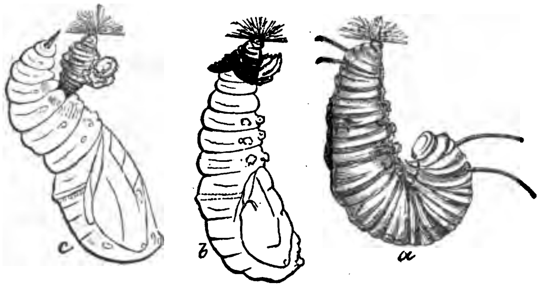


When full grown the worm presents the appearance of Figure 65, the colors being black, white and yellow.

HOW THE LARVA BECOMES A CHRYSALIS.

The metamorphoses of insects will ever prove a source of wonder and admiration. If a naturalist were to announce to the world the discovery of an animal which, for a short term of its life, existed in the form of a serpent; which then, after performing its own interment and weaving itself a shroud of pure silk, changed to something like an Egyptian mummy; and which after remaining thus buried without food or motion, for a much longer term, should at length struggle through its shroud and start into day a winged bird—every one would be interested in the history of such a marvelous creature! Yet the transformation of insects are scarcely less startling than such an occurrence would be, and it is only by drawing such a picture, that we are made to fully appreciate these changes. The methods of transformation are varied, as the reader who has perused these Reports is well aware. A good illustration is often needed in our schools, and as the present species furnishes an excellent illustration of the process in those butterflies which are suspended in the chrysalis state from the tail, and is withal so common that those who desire to witness the process will have no difficulty in doing so, I will give some account of it; for the person who had never witnessed the true method employed, might gaze a long time at the full grown larva (Fig. 65,) and the chrysalis (Fig. 67) without divining how the latter was produced by the former. We have on the one hand a crawling worm, and on the other a legless body hanging securely by

[Fig. 66.]*



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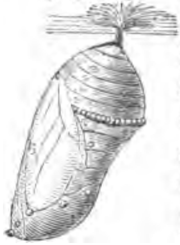
*These figures are drawn from memory and are perhaps a little ideal and inaccurate.

its tail. What has become of the larval appurtenances and how did the chrysalis attach itself? Let us see.

As soon as the larva is full grown it spins a little tuft of silk to the underside of whatever object it may be resting upon, and after entangling the hooks of its hind legs in this silk, it lets go the hold of its other legs and hangs down with the head and anterior joints of the body curved as at Figure 66, *a*. In this position it hangs for about twenty-four hours, during which the fluids of the body naturally gravitate towards the up-turned joints, until the latter become so swollen that at last, by a little effort on the part of the larva, the skin bursts along the back behind the head. Through the rent thus made the anterior portion of the pupa is protruded and by constant stretching and contracting the larval skin is slipped and crowded backwards until there is but a small shriveled mass gathered around the tail (Fig. 56, *b*). Now comes the critical period—the culminating point.

The soft and supple chrysalis, yet showing the elongate larval form with distinct traces of its prolegs, hangs heavily from the shrunken skin. From this skin it is to be extricated and firmly attached to the silk outside. It has neither legs nor arms, and we should suppose that it would inevitably fall while endeavoring to accomplish this object. But the task is performed with the utmost surety, though appearing so perilous to us. The supple and contractile joints of the abdomen are made to subserve the purpose of legs, and by suddenly grasping the shrunken larval skin between the folds of two of these joints as with a pair of pincers, the chrysalis disengages the tip of its body and hangs for a moment suspended as at Figure 66, *c*. Then with a few earnest, vigorous, jerking movements it succeeds in sticking the horny point of its tail into the silk, and firmly fastening it by means of a rasp of minute claws with which that point is furnished. Sometimes severe effort is needed before the point is properly fastened, and the chrysalis frequently has to climb by stretching the two joints above those by which it is suspended, and clinging hold of the shriveled skin further up. The moment the point is fastened the chrysalis commences, by a series of violent jerkings, and whirlings to dislodge the larval skin, after which it rests from its efforts and gradually contracts and hardens until it presents the appearance of Figure 67. The really active work lasts but a few minutes, and the insect rarely fails to go through with it successfully. The chrysalis is a beautiful object and as it hangs pendant from some old fence board or from the underside of an Asclepias leaf, it reminds one of some large ear-drop; but though the jeweller could successfully imitate the form, he might well despair of ever reproducing the clear pale green, and the ivory black and golden marks which so characterize it.

[Fig. 67.]



This chrysalis state lasts but a short time, as is the case with all those which are known to suspend themselves nakedly by the tail.

At the end of about the tenth day the dark colors of the future butterfly begin to show through the delicate and transparent skin, and suddenly this skin bursts open near the head and the new-born butterfly gradually extricates itself; and, stretching forth its legs and clambering on to some surrounding object, allows its moist, thickened and contracted wings to hang listlessly from the body. Under the direct influence of the air, the circulation quickens so that the fluids of the body are driven into every portion of these wings, and they visibly expand under the eye, while the other parts of the body gain in strength and firmness. In less than an hour, and often within half an hour, the wings are ready to perform their intended work and our gay Archippus takes his first lesson in æronautics. Ah! what an enviable fellow is he,

——Lazily flying
Over the flower-decked prairies, West;
Basking in sunshine till day-light is dying,
And resting all night on Asclepias' breast;
Joyously dancing,
Merrily prancing,
Chasing his lady-love high in the air,
Fluttering gaily,
Frolicking daily,
Free from anxiety, sorrow and care!

THE LARVA ENJOYS GREAT IMMUNITY FROM THE ATTACKS OF BIRDS AND OTHER PREDACEOUS ANIMALS.

Many of our insects, from one cause or another, enjoy a wonderful immunity from the attacks of predaceous and parasitic animals and there exists a curious relation between color and edibility. It is a very general rule that those which have such an immunity from the attacks of enemies, are conspicuously colored and feed openly upon the plants they attack; while those which are persecuted are generally of sombre and evasive colors, and often possess some protective resemblance to the objects upon which they occur, or hide themselves in one way or another. For several years past Mr. J. Jenner Weir, of London, England,—a gentleman whom I had the pleasure of meeting some eleven years ago—has made numerous experiments with the direct view of ascertaining what species of insects are eaten by birds and what species are rejected; and the results of these interesting experiments are recorded in the Transactions of the London Entomological Society (1869, pp. 21–26 and 1870 pp. 337–9). They point conclusively to the facts above given, and Mr. A. G. Butler of the British Museum made corroborating experiments, with, lizards, frogs and spiders. Prompted by these experiments made in England, I was led to make similar ones with our gaily colored Archippus larva, and the result fully accords with that obtained by Mr. Weir; for neither turkeys, chickens, toads or snakes would touch it. The reason why predaceous animals refuse these gaily colored larvæ is not always so easy to explain, but in the present case it is undoubtedly owing to an odor which the larva possesses. This odor is hardly appreciable, when the larvæ are in the open air; but by confining a few of them for a short time in a tight box, it soon becomes apparent, and is pungent and nauseous in the extreme even to our sense of smell, and it is doubtless more intensely so to the keener sense of birds and other animals.

Mr. A. R. Wallace believes that the gay colors of such larvæ are really protective, because if by more sombre colors they were undistinguishable from edible species, they would be seized by birds, and though rejected afterwards, would be so much injured that the probability of their producing butterflies would be very remote, even if they were not killed outright.

The same immunity is enjoyed by our Archippus butterfly in all its stages, and especially in the perfect state, in which the peculiar odor is still stronger, as I have abundantly proved.

The larva does not however enjoy entire immunity from parasites as has been hitherto supposed, for though after extensive experience I have never found any of the numerous Hymenopterous parasites attacking it, it is nevertheless often killed by a Dipterous Tachina-fly. I have never noticed any such parasite in the first brood of larvæ, but last year in the immediate vicinity of St. Louis, not one in fifty of the second brood escaped its fatal work; and this same parasite was by no means confined to one locality, as I received it from Mr. S. S. Rathvon, of Lancaster, Pa., who found the Archippus larvæ and chrysalids badly infested. The eggs of the Tachina-fly must be deposited for the most part while the larvæ are young, for specimens of larvæ taken at the first moult and confined in cages where no flies could get access to them, were frequently parasitised. These victimized larvæ usually succumb a day or two before they are full grown, though occasionally one succeeds in effecting the change to the chrysalis. They grow sickly and, hanging by the hind legs, become flaccid and discolored, while the parasitic maggots pierce the skin and fall to the ground, which they enter to transform. A silky liquid escapes from the breathing pores and from the holes made by these maggots, which, when dry, forms long white semi-elastic threads; and as the discolored larvæ hang by hundreds from the milkweeds, with these glistening filaments, one might at first imagine they had been smitten with some epidemic disease.

The Tachina maggot is not specially distinguishable from the many other larvæ of this kind which are known to infest the bodies of other insects, but the spiracles are encircled by a very distinct dark brown ring.*

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* The larva of this Tachina-fly, after it enters the ground, contracts very rapidly to the pupa state, and if retained on a hard surface, one may watch with interest how, as the chitinous covering thickens and hardens, the dark head is vigorously kept at work underneath it, gnawing or abrading the thickening skin in a constant circle, so as to partially sever that portion which serves as a lid to be easily pushed open by the future fly. I have often wondered how this lid in so many

Our Tachina-flies generally very closely resemble each other, and very little attention has been paid to them in this country. The present species seems to be new to science, but I forbear to describe it for the simple reason that it varies so much in itself and so closely resembles many others, that it would be next to impossible to characterize it sufficiently. It may be provisionally known, for purposes of reference, as the Archippus Tachina-fly—*Tachina* archippivora.* It may be at once distinguished from the two flies described in my second Report (p. 51), and which attack the true Army-worm, not only by the different form and smaller size, but by being of a paler gray, and by lacking the reddish or yellowish tail. The eyes are perfectly smooth. An interesting fact connected with this fly is that it likewise attacked the Fall Army-worm (as already mentioned on page 116, note,) which was so abundant at the same time of year. I have also bred it undescribed cut-worm.

The *Tachinariæ* can only be satisfactorily studied in connection with their habits, and even then they must prove a most difficult Division to work up. The species are very apt to grease in the cabinet and where they do not grease, the colors, especially of the face, lose their brilliancy. I am satisfied that the same species often attacks indifferently many widely distinct larvæ and that there are, in consequence, entomophagic varieties. I have a score of different lots, bred from as many distinct species of Lepidopterous and even Coleopterous larvæ; and the individuals of each lot, often bred from a solitary specimen of some particular species of larva, differ more among themselves than from individuals of some other lot, bred from a distinct species of larva. Indeed, unless there are striking characters, it would be folly for any but the specialist to attempt to describe them. These Tachina-flies, indeed, form such an extensive Division that in order to facilitate study, authors have inclined to erect genera upon characters most trivial and such as would certainly not be looked upon as of more than specific value in other groups. Sixteen specimens bred from *Danais archippus* vary from 0.18—0.30 inch in length and from 0.33—0.60 inch in expanse: some have a rufous spot on the side of the second abdominal joint, while others show no signs of any such spot. From among them two somewhat distinct forms occur in about equal numbers. In the one, which is on an average the largest, the abdomen is rather broader, and when dry shrinks so as to become flat, while the antennæ have the third joint from four to five times as long as the second. In the other the abdomen is rather narrower, remains more cylindrical when dry, and the antennæ have the third joint from five to six times as long as the second. These differences are, I believe, sufficient to cause the specialist to make distinct species or even genera; but as the same two forms occur in those bred from other species of larvæ, and as all the other

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coarctate pupæ was so regularly and smoothly opened by the nascent fly; but am now satisfied from observations made on this particular species, that it is previously prepared by the larva while contracting, in the manner described above. This will be more especially the case where the contracted skin is thick as in *Cuterebra, Œstrus,* etc., while in those where the skin is thin and delicate as in *Anthomyia* and many of the smaller *Muscidæ,* the habit probably does not obtain, as the fly can crowd itself out, and the opening is quite irregular, sometimes transverse, at others forming a simple longitudinal slit. I have witnessed the same wonderful forethought in the larva of *Chrysopa,* after spinning its small cocoon. In this case the sharp sickle-like jaws of the larva enable it to cut very finely and smoothly, and the edge of the severed parts show plainly, under the lens, a slight discoloration. The circle inscribed is often, but not always, slightly spiral so that when pushed open the lid hangs as on a hinge. The same habit no doubt prevails in the Lepidopterous genus *Limacodes* and its allies; for I have experimentally proved, by opening several cocoons of *Callochlora viridis,* Reakirt, both while the inmate was yet in the larva or pupa state, that the lid opens with the slightest pressure, and just as regularly as if pushed from within. There is, however, a marked difference in the working in these last two cases and that of our Dipterous larvæ. The former enclose themselves in cocoons, in which they have abundant room to turn round and partially cut their lid, while the Tachina larva performs the work on its own skin while it is hardening and before it has become separated from the transforming body within.

* I forwarded specimens of this fly to Dr. LeBaron, the State Entomologist of Illinois, who is better posted as to the minute generic differences between these flies, than any one else in the West, and he refers it to the genus *Masicera,* Macq., in speaking of which Macquart says: "they are the only *Tachinæ* which have the third joint of the antennæ very long without at the same time having the front very prominent." This and other minor genera of Macquart and Meigen have been discarded by some modern authors, such as Walker and Zetterstedt, and referred to *Tachina.*

details of structure, coloration, etc. are precisely similar, and as these differences themselves graduate, I cannot consider them specific. I have bred the same fly from larvæ of *Prodenia autumnalis* as stated above; also from larvæ of an undescribed Noctuan, closely resembling *Agrotis subgothica*, Haw. These specimens differ only in the rather smaller average size and more slender body, from specimens bred from several other distinct larvæ, and from the pupa of *Cynthia cardui*. It is also an interesting fact that the largest specimens of what appear to be but one species are those bred from the largest larvæ, as for instance that of *Citheronia regalis*.

THE BUTTERFLY OFTEN CONGREGATES IN IMMENSE SWARMS OR BEVIES.

Various butterflies have long been known in Europe, to swarm prodigiously at certain periods; but in this country no other butterfly congregates in such swarms as our Archippus, though the Painted Lady (*Cnythia cardui*), an insect found in all four quarters of the globe, and often seen in swarms in Europe, has been known also to swarm in Canada.

The Archippus butterfly appears in large bevies or flocks almost every year in some part or other of the West. In September, 1868, I received accounts of their sudden appearance in different parts of the city of Madison, Wisconsin, and at Manteno, Ills.; while on the 19th of that month Mr. P. B. Sibley of St. Joseph, Mo., sent me specimens with the statement that he saw millions of them filling the air to the height of three or four hundred feet, for several hours flying from north to south, and quite as numerous as the grasshoppers had been the year before.

In the spring of 1870 I received the following account of such a swarm from L. J. Stroop of Waxahachie, Ellis Co., Texas:

During my ramble this morning (March 31st) I happened upon a flock or bevy of butterflies known as *Danais archippus*, Fabr., containing thirty individuals, four of which I captured for the purpose of identification, only two of which, however, I pinned down. I find them to be of the genuine *archippus*, identical in every respect with specimens bred from the caterpillar by myself last summer, except in that of color, which is somewhat paler in these captured this morning than it was in those bred by me in the summer. They have the appearance of having been on the wing some days.

A little later the same spring similar swarms were noticed in different parts of Kansas, the most remarkable of which was one which occurred at Manhattan about the middle of April, and which, as I learn from Mr. Thos. Wells of that place, came rapidly with a strong wind from the N. W. and filled the atmosphere all around for more than an hour, sometimes so as to eclipse the light. Again, large flocks passed over the same place in a southerly direction, on the evening of the 27th and morning of the 28th September, while at Alton, Illinois, great numbers of them were seen passing in a S. W. direction on the last day of October of the same year.

It would be difficult to give any satisfactory reason for this assembling together of such immense swarms of butterflies. Insects otherwise solitary in their habits sometimes congregate thus for purposes of emigration; but this can hardly be the object of our butterfly bevies. They certainly do not travel very long distances or we should hear more numerous accounts of them. There are two significant facts connected with them from which some corollary might be deduced, namely, that only those species which have a very extended range are known to form such flocks, and that they always travel, under these conditions, in a southerly or south-westerly direction. Mr. Bates* gives an interesting account of the uninterrupted processions of butterflies belonging to the genus *Callidryas*, which passed from morning to night in a southerly direction across the Amazons; and as far as he could ascertain these migrating hordes were composed entirely of males.

If our Archippus flocks should turn out to be all males, this fact may lead to some solution of the cause of their congregating; but I incline to believe the flocks are composed of both sexes. Again, if the swarms occurred during the egg-depositing season, we might even then venture to solve the problem. For it is evident that a species which enjoys such immunity from predaceous animals and which is confined in its diet to a single family of plants, must occasionally multiply in particular districts beyond the capability of the plants to sustain them; and as most female butterflies instinctively refuse to deposit eggs on a plant that has already been abundantly supplied by some other individual, the females of our Archippus would naturally roam in vain for fresh plants when once the latter had all been stocked; and would thus congregate together, and, followed by the males, form migrating bevies. Or we might suppose that after the larvæ had eaten up all the milk-weeds in a district, the butterflies they produced, finding no plants upon which to lay their eggs, would be forced to migrate in swarms. But neither of these suppositions can have much weight from the fact that the swarms occur either late in the fall or early in spring; and the most plausible solution under the circumstances is that, as these are the seasons when the milk-weeds are either destroyed or have not yet started to grow, the butterflies, having nothing to confine their attention and keep them isolated, naturally congregate together, and that when in motion, the low temperature of the seasons instinctively prompts them to wend their way southwards. The probabilities are that these swarms are eventually destroyed, for no species can multiply beyond a certain limit, and when there is not check to increase in one direction, there will be in another. Of course this is as yet all theory and hypothesis, but hypotheses in such cases are necessary, for they are threads on which to string and combine the known parts of a case so as ultimately to arrive at the real truth in the matter.

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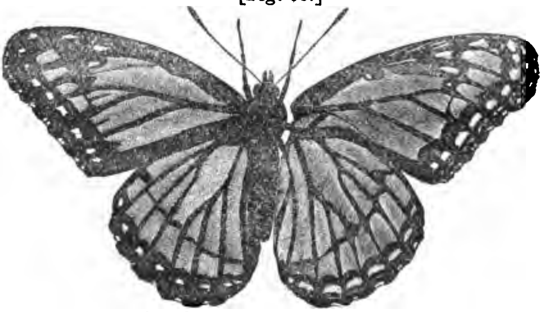
* Naturalist on the River Amazons, I, p. 249.

THE DISIPPUS BUTTERFLY—*Limenitis disippus*, Godt.

(Lepidoptera, Nymphalidæ).

This is another butterfly (Fig. 68) which is well known in the Mississippi Valley. It belongs to a family which agrees with that to which the previous insect belongs, in the front pair of legs being more or less functionally impotent, but differs remarkably from it in the large cell in the centre of each wing never being closed externally by a distinct tubular vein, and in its being generally open towards the outer margin of the wing: also in lacking the small nervule at the base of the front wing, spoken of on page 143.

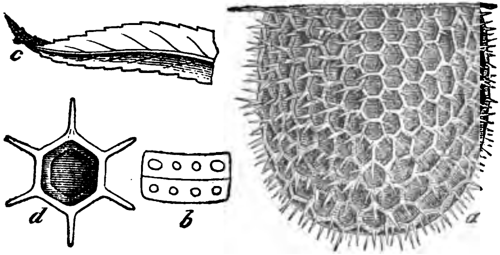
[Fig. 68.]



The food-plants of the Disippus butterfly are Willow, Poplar and Plum, and though not as numerous as the Archippus, it is yet tolerably common in the Mississippi Valley and occurs sparingly all over the United States and in the West Indies. As will be seen by referring to the figure*, though belonging to an entirely distinct family, it nevertheless bears a great general resemblance to the Archippus butterfly, and this resemblance is rendered more striking by the colors of the two insects being identically the same.

The natural history of this species is fully as interesting as that of the Archippus butterfly—if not more so. The egg which, so far as I am aware, has never before been described and figured, differs remarkably from that of the Archippus butterfly and is well represented at Figure 69, *a* showing it greatly magnified, *c* of the natural size and *d* giving a greatly magnified view of one of the cells with the filamentous processes from each angle of the hexagon. The color is at first pale yellow but soon becomes gray as the embryo within develops. It is usually deposited singly near the tip of the leaf, generally on the underside but often on the upper side; and I have exceptionally found as many as three together, and sometimes one on either side of the leaf, opposed to each other.

[Fig. 69.]



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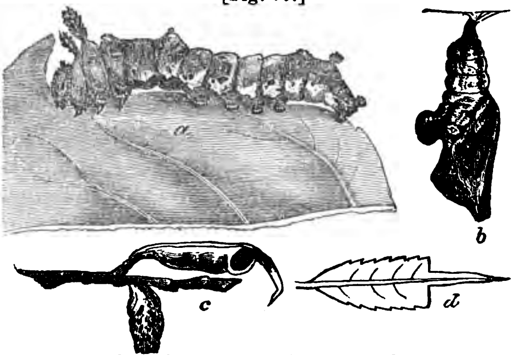
* In Figure 68, which represents the Disippus butterfly, the left wings represent the upper surface, and the right wings, which are detached from the body, represent the lower surface. The difference in the coloration of the two surfaces is but slight in this species, neither does it amount to much in the Archippus butterfly; but in some butterflies and in others belonging to the same genus, it is very considerable.

Description of the Egg.—Length 0.38 inch. Diameter at base about the same. Globular, with the top often slightly depressed. Hexagonally reticulate, the cells more or less regular, sunken so as to give the egg a thimble-like, pitted appearance, and about 10 of them in the longitudinal row and 30 in the circumference. Covered with translucent filamentous spines, one arising from every reticulate angle and giving the egg a pubescent appearance. Each spine about as long as the cell is wide, those on the top being longest.

The young larva differs materially from its more mature self, as will be seen from the description which follows. It grows apace, casting off its old coat and devouring the same three times during its growth, and eventually suspending itself by the hind legs and transforming to the chrysalis, frequently within a month from the time of hatching. The mature larva (Fig. 70, *a*) presents a roughened tubercled appearance and varies much in color, the predominant colors being moss-green, brown and creamy-white; the moss-green parts being studded with beautiful light blue points. The pupa Fig. 70, *b*) is marked with burnt-umber brown, ash-gray, flesh-color and silvery white, and is characterized like that of the other species of the genus, by a curious thin almost circular projection which has been likened to a Roman nose, growing out of the middle of its back.

[Fig. 70.]



Description of mature Larva.—Length 1.20, diameter 0.25 inch. General color *either* whitish or olive-green. Body thickly granulated. Head dull olive, with dense minute prickles; its vertex bifid and terminating in a pair of prickly cylindrical horns, transversely arranged and each about 0.03 inch long. Back speckled and mottled with olive of different shades above the line of the spiracles, except joints 2 and 8 and the upper part of 7 and 9, but with a continuous pure white line below the spiracles, beneath which white line on joints 4–10 is a large olive patch extending on joints 6–9 to the external tip of the prolegs. A pair of black transversely-arranged dorsal dots in the suture behind joint 2, and a more or less obvious lateral one just above and behind the 5th and 7th pair of stigmata surmounting the lateral white line. Joints 3–7 and 9–11 with more or less, shining, elevated, blue dots. On joint 2 a pair of prickly cylindrical black horns, transversely arranged and 0.16 inch long. On joints 3, 10 and 11 a pair of large dorsal tubercles transversely arranged, each crowned by a little bunch of 8–12 robust prickles. On joint 5 a pair of similar tubercles, but still larger, of a yellowish color, and mamma-like. On joints 4, 6, 7 and 9 tubercles similar to those on joints 3, 10 and 11, but smaller. On joint 12 four black prickly dorsal horns, quadrangularly arranged and each about 0.03 inch long. Stigmata and legs blackish.

Described from many specimens. Such are the prominent and more constant traits of this larva, but it is so variable in the general depth of coloring and in the proportion of the lighter and darker shades that it is next to impossible to frame a description which shall alike agree with half a dozen specimens.

The newly hatched larva presents a quite different appearance. It is 0.09 inch long with a yellowish-brown head twice as large as the first joint and distinctly bilobed. The first joint is also larger than the others. Each joint is divided by a transverse impressed line, and upon the dorsum of each fold thus made are 4 pale elevated spots, the anterior outer ones larger than the rest, as shown at Fig. 69, *b*, especially on joints 2, 3, 5 and 11 where they appear conical with a darker annulation at base. There is a subdorsal and a sub-stigmatal row of similar rounded warts, and they all give rise to little pale bristles or spines. The general color is pale yellowish-brown, mottled with dark streaks, especially below the stigmata. The second period scarcely differs from the first except in the somewhat greater length of the horns. In the third period the horns acquire their mature proportions, and the whole larva becomes more granulated. In the fourth or last the blue points appear and the lateral rows of tubercles lose their conspicuousness to a great extent.

ITS WINTER QUARTERS.

One of the most interesting features in the life-history of our Disippus butterfly is its mode of hibernating. A great many moth larvæ pass the winter in the larva state sheltered in one way or another; but no other American butterfly has hitherto been recorded as hibernating in this state, except the closely related Ursula butterfly,* though no doubt the few other species belonging to the same genus possess a similar habit. Misled, perhaps, by the fact that the butterfly is seen flying about so early in the spring that it could not have had sufficient time to hatch out from the egg and acquire its full larval growth the same season. and with its wings so bright and unworn that it could not have hibernated as a butterfly as some other closely allied species are known to do; Dr. Harris, in his work on Injurious Insects (p. 282) asserts that it hibernates in the pupa state, though he subsequently, in the year 1850, became aware of the facts in the case.†

In reality the larvæ of the autumnal brood, when about one-fourth or one-third grown, build for themselves curious little houses (Fig. 70, *c*), in which they pass the winter. First and foremost—with wise forethought, and being well aware through its natural instincts, that the leaf which it has selected for its house will fall to the ground when the cold weather sets in, unless it takes measures to prevent this—the larva fastens the stem of the leaf with silken cables securely to the twig from which it grows. It then gnaws off the blade of the leaf at its tip end, leaving little else but the mid-rib, as shown in Figure 70, *d*. Finally, it rolls the remaining part of the blade of the leaf into a cylinder, sewing the edges together with silk.‡ The basal portion of the cylinder is of course tapered to a point, as the edges of the leaf are merely drawn together, not overlapped; and invariably the lower side of the leaf forms the outside of the house, so as to have its projecting mid-rib out of the way of the larva, as it reposes snugly in the inside. The whole when finished (Fig. 70, *c*) has somewhat the appearance of the leaf of a miniature pitcher-plant (*Sarracenia*), its length being 0.50–0.65 inch, and its diameter 0.11–0.14 inch.

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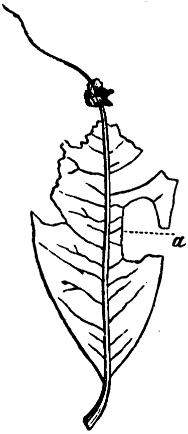
*There is good reason to believe, however, that some of those butterfly larvæ which habitually protect themselves by a sort of loose cocoon, made by drawing together or rolling up the leaves of their food-plant; likewise pass the winter in the larval state. At least I have known an oak-feeding larva of *Nisoniades juvenalis*, Sm. and Abb., kept by a lady friend of mine, to remain in the larva state nearly all winter before transforming to the chrysalis. But there is not strict analogy between such a case and that of the hibernation of the immature *Disippus*.

† *Harris Correspondence*, p. 245.

‡ In the article in the *Am. Entomologist*—which was the greater part of it written by Mr. Walsh, with my own facts and experience inserted here and there—it is stated that the "gnawed portion of the leaf forming the flap, is bent down and fastened by silken cords, so as to act as a door to the house." After fuller experience, I find that this is very seldom the case, but that the orifice is more often left open.

These curious little cases may be commonly found upon our willows or poplars in the winter time. I have examined hundreds of them, and although they are invariably built upon the same plan, they vary greatly in the degree of perfection which the architect attained; and this is especially the case when they have been built in confinement. The blade on the tip piece is sometimes gnawed off right down to the rib; at others it is left almost as broad as the tube. Sometimes it is bent over the orifice; at others not. They are also much more irregular and ungainly when made from broad leaves such as those of the Silver poplar, than when made from the more narrow leaves of the Willow. These autumnal larvæ have also another peculiar habit not heretofore recorded, and which was first pointed out to me by Mr. J. A. Lintner, of Albany, N. Y. They exhibit a tendency to build from the time they are born, and will always eat the leaves from the side, gnawing large holes and cutting along the sides of the mid-rib, as at Fgure 71, *a*. They commence at the tip and as they work downwards towards the base, they collect the debris into a little bunch, which they fasten with silk to the mid-rib. When the hibernaculum is finished the seam is perfectly smooth and the whole inside is lined with silk. The larva, after completing its work, composes itself for the winter, with the tail towards the orifice. Here it remains till the catkins are in bloom the next spring, when it retreats from its house and commences feeding. Not the least wonderful part of the phenomenon is, that it is only the autumnal brood of larvæ that form pitcher-like houses to live in during the inclement season of the year, the summer brood having no occasion to shelter themselves from the cold. We thus have an instance of a curious architectural instinct being only developed in alternate generations; which is much the same thing as if, with a certain race of men, the great-grandfathers, the fathers and the grandchildren ran wild in the woods, and the grandfathers, the sons and the great-grandchildren lived in houses and led the life of civilized human beings.

[Fig. 71.]



When we duly consider this peculiarity in our Disippus larva, we may well pause and ask—

What wondrous power enables it so well,
The coming cold of winter to foretell,
And to provide for its long torpid rest,
A house, from means at hand, the very best?

We can but admire the beautiful adaptation of means to an end —no matter how we choose to explain it! There can be little doubt but that many of the phenomena in animal life which we so summarily dispose of by the ready use of that rather blind term "instinct," might be explained in a more natural way. The term is justly applied to those actions which are prompted by exterior influences or peculiarity of organization, and which are performed unconsciously; but by its too general application, most people have acquired a deep-set idea that all animals act under its power, and have nothing akin to our reason; whereas there is hardly anything more certain than that true reason of degree exists very generally in the animal kingdom; or that what we know as pure instinct may have been developed by natural law, *i. e.*, first acquired by experience and afterwards fixed as a habit by heredity.

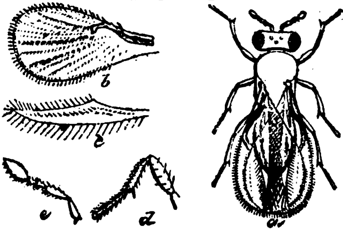
The subtle influences of the late fall which seem to convey through every pulse of nature, intelligence of the approaching winter, and which cause all animals to prepare for their hyperborean sleep, no doubt originally induced the young larva of the ancestral type from which our Disippus and the other species of the genus sprung, to prepare for itself some shelter. The gradually increasing cold and the decrease of nourishment in the leaf, would act as physical prompters, and the pitcher-like house, which at first strikes us as so remarkable, is the simplest structure that could be made with the materials at command. The characteristic smoothness of its food-plant—forbidding as it does the shelter under loose bark which many larvæ seek—would also tend to develop such a trait. That this trait —this instinct—should only be developed under similar conditions to those which gave birth to it, is not so remarkable; and that it does only so develop, seems certain, for I have every reason to believe that while the insect is two-brooded further north, it is sometimes three-brooded with us, and consequently that this peculiar instinct obtains either in the second or third generation, according to circumstances.

ITS PARASITES.

Though not generally known to entomologists, our Disippus butterfly is very subject to the attacks of parasites, at least three distinct species infesting it in the preparatory states. One of these is a *Tachina*-fly, of which I have often noticed the eggs fastened transversely on the back of the neck of the larva, but of which I have not obtained the fly. In all probability it does not destroy the larva till the latter is nearly full grown. The other two I will briefly describe as no mention has heretofore been made of them.

The Disippus Egg-parasite.—The eggs already described were very abundant last fall on a certain clump of willows near Kirkwood, and of about two hundred obtained, fully one-half of them were parasitised. Instead of hatching out into larvæ, as they would have done if they had been unmolested, these last produced little dark colored four-winged flies, from four to six of which

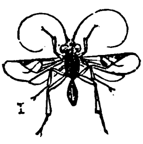
[Fig. 72.]



would gnaw their way through the shell of each egg. This little fly belongs to the great *Chalcis* family, and though scarcely more than 0.02 inch long, it can jump to the distance of several inches. Its wings, especially the hind ones, are beautifully fringed with hairs. It is inconspicuously marked, the body being dark brown with the antennæ and legs pale, and the wings iridescent. The highly magnified outlines at Figure 72 will convey a good idea of its appearance, *a* showing the fly with wings folded on the back, *b* one of the front wings, *c* one of the hind wings, *d* one of the legs, and *e* one of the antennæ.

I shall leave the proper determination of this insect to those who pay more particular attention to the CHALCIDIDÆ. It comes nearest the genus *Trichogramma*, Westw., and may be provisionally called *Trichogramma* (?) *minuta*. It differs from that genus and from all other Chalcididan genera with which I am acquainted, in the antennæ being but 5-jointed (scape, plus 4 joints), the scape stout and as long, or longer, than joints 2, 3 and 4 together; joints 3 and 4 small and together as long as joint 2; 5 very stout, fusiform and as long as 2, 3 and 4 together. The legs have the trochanters stout and long, the tibiæ not quite so long nor so stout as the femora, and with a long tooth; the tarsi are 3-jointed, with the joints of equal length and with the claws and pulvilli sub-obsolete. The abdomen is apparently 6-jointed, the basal joint wide, the 2nd narrower, 2—5 increasing in width till 5 is as wide as 1. The ovipositor of ♀ extends a little beyond the apex, and starts from the anterior edge of the 5th joint.

[Fig. 73.]



THE DISIPPUS MICROGASTER.—The third parasite which also very commonly infests the last brood of larvæ, and kills its victim during the second period, is a little black four-winged fly belonging to the genus *Microgaster*. The parasitic maggot eats its way out just before the Disippus larva gets ready to build its winter tenement, and spins a pale yellowish cocoon of silk, either upon the back of its victim or upon the leaf close by; and from this cocoon the fly soon afterwards issues. Figure 73, which represents the Army-worm *Microgaster* enlarged, will convey a good idea of its Disippus relative.

The genus *Microgaster* is a very extensive one, and the species have not yet been well studied in this country. They are all of small size, and in many instances resemble each other so closely that they can only be satisfactorily studied in connection with their habits and the particular larvæ which they infest. Some appear to confine their attacks to one particular kind of caterpillar, while others infest alike many different species. Thus the one under consideration not only infests the Disippus larva, but I have also bred it from that of the Golden-rod Gall-moth (*Gelechia gallæsolidaginis*, Riley) obtained from Canada; which indicates it to be a widely distributed species.

MICROGASTER LIMENITIDOS, N. Sp.—♂ ♀. Length 0.09 inch. Color pitchy-black. Antennæ black, about as long as body; palpi whitish. *Thorax* minutely punctured. *Abdomen* with the two or three basal joints emarginate and rugose, the terminal joints smooth and polished. *Legs* dusky; front and middle femora yellowish, hind femora black; front and middle tibiæ yellowish, hind tibiæ with terminal half dusky, but the spur pale; front and middle tarsi yellowish tipped dusky, hind tarsi dusky above, paler below. *Wings* hyaline, iridescent, the nervures and st black or dark-brown, the radial nervule, the cubital nervules and the exterior nervule of the coidal cell, sub-obsolete.

Described from 6 ♀, 1 ♂, bred from larvæ of *Limenitis disippus,* 3 ♀ bred from larvæ of *Gelechia gallæsolidaginis.* In the latter the nervures of wings are paler and less distinct than in the former. Most of our N. A. species of this genus have been described by Mr. Cresson who has seen this and considers it new. It certainly differs from the other described species.

MIMICRY AS ILLUSTRATED BY THESE TWO BUTTERFLIES, WITH SOME REMARKS ON THE THEORY OF NATURAL SELECTION.

The means by which animals are enabled to escape from their enemies and obtain their food, or in other words - to sustain themselves in the great struggle for existence that is continually going on between each species, are as varied as they are wonderful. There is generally a conformity of tint between all animals and their surrounding, and in the higher classes Mr. A. R. Wallace has shown* that in general terms it may be stated that desert animals are desert colored, arctic animals white, and nocturnal animals gray, *i. e.*, of such colors as best to accord with the surroundings. Animals, birds, fishes and reptiles come under this rule to a great extent, and the reader will be amply rewarded by perusing the details given in the valuable and interesting work referred to. But in no Class of animals does this principle of adaptation to environment occur so generally and in such a striking manner as in insects. With them mimicry and other protective resemblances are almost universal, and it may be given as a rule that all insects living above ground, when not naturally protected by odor, luminosity or defensive covering such as hairs, spines, hard shelly wings, etc., or by armor such as stings, beaks, etc., either cover themselves with one substance or another, or similate their surroundings, or mimic either other animals, plants, or even inorganic substances. With insects in their larval states, will this rule especially hold good.

What entomologist has not been deceived by the close resemblance of the beetles belonging to the genus *Chlamys* to the dung of caterpillars; or is not familiar with the quaint and close resemblance of the Walking-sticks and Walking-leaves to the objects from which they take their names? Chapter after chapter might be written on these wonderful imitations which deceive the best trained eyes; and there are many most striking instances among our American insects which have never yet been published and which I hope some day to illustrate. But my present purpose is simply to draw attention to the illustration afforded by the two butterflies which we have been considering.

These striking resemblances were formerly looked upon, for the most part, as curious analogies in nature, intended to carry out the general plan of the Creator; but viewed in the light of modern science, and especially by that of the Darwinian development hypothesis, they have acquired an immense significance. One of the most interesting phases of this mimicry, and one which has only within the last few years been brought to light, is the imitation by an otherwise defenseless butterfly, of one whose great numbers and wide distribution indicate that it enjoys peculiar advantages. This specific imitation of one butterfly by another is precisely of the same nature as the mimicking of a vegetable or inorganic substance, and may consequently be just as properly termed mimicry. Some authors seem to make a distinction between this so-called mimicry and what is known as "protective resemblance," while others again misconceive the true import of the word "mimicry" as used in this connection. Thus, Maj. J. R. Muhleman in an essay on "Mimicry in Insects," read before the Central Illinois Horticultural Society this winter, gave the word so broad an interpretation as to apply it to the possum-playing of some insects, and even to the supposed and far-fetched resemblances such as that of the female Canker-worm to a plant-louse, and of the female Bag-worm to a Dipterous maggot. True mimicry can only occur where it is of benefit to the species, no matter whether the benefit be derived by enabling harmless species to avoid their enemies in one way or another; or by enabling predaceous species to deceive their prey by assimilating the form and colors of the latter.

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*Contributions to the Theory of Natural Selection.

As already stated, the particular group to which our Archippus butterfly belongs is a large one, and the species comprising it are very numerous. They are especially abundant in South America, and like our own species, they all possess a pungent odor which seems to pervade all the juices of their system. So much is this the case that according to Mr. Wallace,* when an entomologist "squeezes the breast of one of them between his fingers to kill it, a yellow liquid exudes which stains the skin, and the smell of which can only be got rid of by time and repeated washings." The wings of these butterflies, as may be seen by referring to Figure 63, are rather longer than usual, but their flight is comparatively slow, and they do not dodge and zig-zag about with sudden skips and jerks as the "Skippers," (HESPERIDÆ,) are known to do. They furthermore possess no adaptive coloring to protect them during repose, for they take no pains to hide themselves, and their colors are bright, and those of the under-side as conspicuous as those of the upper.

Hence we cannot assume that they are enabled, by their peculiar mode of flying, to escape to a great extent those cannibal animals that would otherwise catch and devour them; and if we propose to account for their prodigious abundance at all, we are driven to have recourse to some other hypothesis. Indeed, so far is it from being the case that it is their mode of flight which enables them to escape from their cannibal foes, that Mr. H. W. Bates, the English naturalist, who spent eleven years in the Valley of the Amazon River, studying the natural history of the insects of that region, where this particular group of butterflies is very copiously represented, declares that he never saw a single one of them attacked by any cannibal foe whatever, whether bird, or Dragon-fly, or lizard, or *Asilus*-fly.

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*Contributions, etc., p. 78.

It is therefore reasonable to assume that their peculiar odor renders them unpalatable to animals of prey. We have seen that the Archippus butterfly enjoys an almost perfect immunity from the attacks of predaceous animals, consequent, in all probability, upon this peculiar odor which attaches to it both in the larval and perfect states. In this case the supposition is even strengthened by the fact that the only parasite known to attack it is a *Tachina*-fly, belonging to a family which is notoriously defiant of strong odors, the larvæ often rioting in filth and the flies many of them known to be especially attracted to such odors.

Now there is another large group of butterflies, known as the *Pieris* family, to which the white cabbage butterflies belong, which were mentioned in my last Report (pp. 104–110.) This group differs widely in structure from the *Danais* group, and is represented by many species in the Valley of the Amazons; but instead of the species being exceedingly abundant in individuals, as in the case of those belonging to the *Danais* family, it is quite the contrary; the proportion between the number of individuals belonging respectively to two of the commonest genera of either group (*Leptalis* and *Ithomia*) being only 1 to 1000. Hence, it is reasonable to infer that this group must be much persecuted by cannibal foes, and such has been found to be the case.*

The colors found in the species of the *Danais* family are red, yellow, orange, white and black; while only the last two colors obtain in the *Pieris* family, the white being sometimes tinged with greenish yellow. So far so good. We see flitting about in the great Valley of the Amazons, vast swarms of long-winged butterflies, gorgeously dressed in red, orange, yellow, white and black; and certain short-winged butterflies, in very much smaller numbers, whose proper livery is but the plain black and white that befits a funeral. We see the former enjoy an entire immunity from the attacks of all predaceous animals, and the latter snapped up by every hungry bird, Dragon-fly or *Asilus*-fly that happens to come across them. Will it be believed, now, that there are certain particular species of the homely, much persecuted, short-winged group, that assume the livery worn by certain particular species of their gaily dressed compatriots, and actually even copy their elongated wings? Yet such is the indubitable fact. In the Memoir of Mr. Bates, already referred to, will be found beautiful colored figures, in the highest style of art, both of the species that mimic and of those that are mimicked; and no one that looks at those figures with an unprejudiced eye can believe for a moment that the resemblance is merely accidental.

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*These facts were first brought to light about nine years ago, by Mr. Bates, in a most interesting and valuable Memoir, published in the Transactions of the Linnæan Society, (Vol. XXIII, p. 495.)

Even the practiced eye of the entomologist is sometimes deceived by these close resemblances, and to illustrate, I cannot do better than to quote Mr. Bates's own language:

> These imitative resemblances, of which hundreds of instances could be cited, are full of interest, and fill us with the greater astonishment the closer we investigate them; for some show a minute and palpably intentional likeness which is perfectly staggering. I have found that those features of the portrait are most attended to by nature, which produce the most effective deception when the insects are seen in nature. The faithfulness of the resemblance, in many cases, is not so striking when they are seen in the cabinet. Although I had daily practice in insect-collecting for many years, and was always on my guard, I was constantly deceived by them when in the woods. (p. 507).

Mr. Bates accounts for these singular cases of mimicry by supposing that, ages and ages ago, certain individuals of this plainly-dressed and much-persecuted *Pieris* family happened to vary slightly so as to resemble slightly some species or other belonging to the gaily-dressed and unpalatable *Danais* family; that, in consequence of this slight resemblance, they were sometimes mistaken for their more fortunate compatriots by cannibal animals, which would otherwise have preyed upon them forthwith; and consequently that they survived long enough to propagate their species, while almost all the individuals that had not varied in this particular manner perished prematurely by a violent death. Now, we know that, in the language of breeders and stock-raisers, "like produces like," which is what naturalists express by the well-known term of the "Law of Inheritance." Hence the descendents of this primordial race of imitative butterflies would naturally, most of them, vary in the same manner as did their ancestors from the normal type; and some of them would probably vary in a still more marked manner and in the same direction. These last individuals, as they would bear a still closer resemblance to the unpalatable butterflies, would of course stand a still better chance of surviving and propagating their species, in the course of that great Struggle for Existence, which we see going on all around us, not only among the inferior animals, but among the human species itself. By the perpetual repetition of this process, during indefinite ages, that perfect imitation of the imitated butterfly would at length be formed, which at first view appears so utterly inexplicable. And when it had once been formed, the very same process that originally formed it would afterwards keep it up to the standard of perfection. For all individuals, that varied in a backward direction towards the primordial type, would be more liable than the rest to be devoured in early life by cannibals, and would therefore be less likely than the rest to propagate their own image in succeeding generations. The whole process, indeed, is so beautifully simple and intelligible, that, but for certain prepossessions and prejudices, it would at once command the assent of every logical mind. In fact, it is strictly analogous to the common operation of "rogueing" a bed of seedlings, which every gardener is familiar with. The only difference is that, when the gardener pulls up what he calls the "rogues" out of a thousand seedling tulips, *i. e.*, those which deviate from the standard of perfection which he is aiming to attain, he acts with the definite object of preventing the further propagation of those so-called "rogues;" whereas, when cannibal animals destroy the "rogues" among the imitative butterflies, they are of course perfectly ignorant of the consequences likely to follow, and act wholly and solely for the gratification of their own carnal appetites. In short, the whole phenomenon is explained on the theory of Natural Selection as expounded by Darwin.

Since the publication of Mr. Bates's paper, a great many additional cases of similar mimicry among butterflies have been observed by Mr. Wallace* in the Malayan region of South America, and by Mr. Trimen in South Africa.† But though most of these wonderful cases of mimicry occur in the tropics, where insect development is so rapid and species are so abundant, we also have a striking instance of similar mimicry in our two N. A. butterflies, *Archippus* and *Disippus*. The resemblance between them must long ago have been noticed, for it is so servile that Prof. Jaeger in his *Life of North American Insects*, has actually favored his readers with a figure of the Disippus and gravely informs them that it is the Archippus butterfly. Indeed it is far more striking than my figures would indicate, and in a state of nature the two insects could hardly be distinguished at a short distance by the sharpest eyes. The fact that these two species offer an illustration of similar mimicry to that observed so frequently in the tropics, was first made clear by Mr. Walsh and myself in the *American Entomologist* for June, 1869; and the facts which have since come to my knowledge all tend to confirm the opinion.

The only other species belonging to the same genus as our Disippus butterfly, which occurs in the Mississippi Valley, is the Ursula butterfly‡ (*Limenitis ursula*, Fabr.), an insect which differs remarkably from our Disippus in being of a sombre blue-black color, with its wings bordered both above and below with blue, and below with a series of dull orange spots inside the blue border. Its larva feeds on Willow, Scrub-oak, Whortleberry, Cherry and Plum, and as already stated, has the same habits as that of Disippus, which it resembles so closely as scarcely to be distinguishable. The pupæ of the two species are also undistinguishable.

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* See the Chapter on Mimicry among Lepidoptera in his Contributions, etc.

† See his paper on "Mimetic Analogies among African Butterflies," in the Transactions of the Linnæan Society for 1868.

‡ There are seven described species of N. A. *Limenitis*, but with the exception of the two above named they are all confined to the more eastern or western portions of the Continent.

If this Ursula butterfly were placed side by side with the Archippus butterfly, everybody would say at once that no two species could possibly be more unlike in the general style of their coloration. Clearly, therefore, it cannot be considered as in any wise mimicking the latter. Now, the Ursula butterfly is found everywhere throughout the Northern States wherever the Disippus butterfly is met with, and yet, while the latter is a common and abundant species, the former is quite rare. This is certainly the case in the Mississippi Valley, and will, according to my own experience, and that of others* very generally hold true all over the country.

To what are we to attribute this fact? It can scarcely be owing to structural differences in the external organization of the two species; for the two belong to one and the same genus. It surely cannot be because the larvæ of the former are more exposed to the attacks of predaceous animals than those of the latter; for they inhabit the same, or very nearly the same trees, and in size, shape and general coloration the two are almost exactly alike. Certainly it can not be because the pupæ of one species are more subject to be devoured by birds, insects, etc., than those of the other species; for it is impossible to tell one pupa from another when placed side by side. The only cause to which we can reasonably attribute the great abundance of the Disippus butterfly and the comparative rarity of the Ursula butterfly is, that the former mimicks the Archippus butterfly, as has been shown above, and is consequently often mistaken by birds, tree-frogs, Dragon-flies, *Asilus*-flies and other beasts of prey for its unsavory prototype and allowed to escape with impunity, while the latter, having no such disguise, is ruthlessly devoured by every insect-eating animal that can get hold of it.

All the facts lead to such a conclusion. The mimicked species enjoys an almost perfect immunity from the attacks of enemies in all its stages, while the mimicker is persecuted by several. The mimicker is often found in company with the mimicked, as I have myself, and as others have witnessed.† But what is still more conclusive is the fact observed by Mr. S. H. Scudder‡ that in the extreme Southern States where the Disippus butterfly occurs, and Archippus is replaced by the Berenice butterfly—a species of the same genus and of similar appearance but of darker color—the color of the mimetic Disippus deepens nearly or quite to the tint of the Southern *Danais*. Thus it is that facts before unintelligible are explained by Darwinism!

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* According to Mr. J. A. Lintner, *Ursula* is "rare" and *Disippus* is found abundantly in New York. (*Proc. Ent. Soc. Phil.*, III., pp. 63–4.) According to Mr. J. Kirkpatrick *Ursula* is "rather rare" and *Disippus* "common in the fall" in Ohio. (*Ibid.*, p. 329.) According to Mr. Sam H. Scudder, *Ursula* is "rather rare" and *Disippus* is "common" in New England. (*Proc. Essex Inst.*, III., p. 165.) According to Mr. Billings, who does not seem to have met with any *Ursula* at all, *Disippus* is "very common from July to October" in Canada West. (*Canad. Entom.*, I., p. 45.) There appear to be some exceptions to this rule, however, for Mr. Thos. W Higginson, of Newport, R. I., declares (*Am. Entomologist*, II., p. 177.) that *Ursula* is one of the commonest of the large butterflies there and decidedly more so than *Disippus*. I was also informed while at Troy last fall, that the former outnumbered the latter in the vicinity of New York City in the year 1868, though the previous years it had been quite rare. These exceptions to the rule may be owing to one cause or another, but I shall attempt to explain them when I come to consider the objections to the theory which I espouse.

† Mrs. Mary Treat, of Vineland, N. J., writes that *Archippus* was unusually abundant there last fall, and that she found *Disippus* in company with it.

‡ *Nature*, Vol. III, p. 147.

In a discussion on the difficulties of Natural Selection, which took place in late numbers of the London journal *Nature*, some ingenious objections have been urged. As many of them have especial reference to the mimicry we have been noticing, a brief summary of these objections will prove interesting in this connection, the more especially as all objections must in the end only serve to strengthen a theory, if that theory is sound.

Mr. Alfred W. Bennett* undertakes to show upon mathematical considerations, that Natural Selection could not produce these mimetic forms. He assumes that it would take 1000 steps to enable the normal form of a *Leptalis* for instance, to pass into the protective form of an *Ithomia*; that no change less than one-fiftieth of the whole alteration—*i. e.* 20 steps—would be of any use to the insect, and that the alterations in the early stages, being useless to the animal, would not be preserved, and even if they were, could not be attributed to Natural Selection, but to an accumulation of chances. He reiterates what has already been well shown and acknowledged by Darwinians, namely, that Natural Selection cannot produce the first change, and asks with good reason why the same principle that works the first change should not also work the subsequent changes? He does not dispute the secondary power of Natural Selection, but believes in an unconscious organizing intelligence which co-operates with it to produce the mimetic results. He endeavors to strengthen his position by showing that there is a close connection between instinct and mimicry, and ventures the theory that "the power of mimetism, so far as is known at present, runs almost *pari passu* with the development of the nervous system."

The essay is an able and interesting one, and the arguments are skillful and ingenious. It pays due and just respect to Darwinism and forcibly presents the fact, which no one has denied, that some other power than natural selection acts in producing first change The mathematical argument, however, will have little weight with those who fully appreciate the changes in Lepidoptera that take place in nature. No entomologist who has had any experience in rearing Lepidoptera will admit with Mr. Bennett that 1000 steps are necessary to produce mimetic resemblance, and when this foundation stone of his objection is taken away, much of his other reasoning which is built upon it becomes weak. Instances of great and sudden variation among butterflies and more particularly among moths are by no means rare. In this Report instances of great variation in species have been given, and hundreds of others might be cited.*

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* *Nature*, Vol. III, pp. 30-33.

Mr. Bennett furthermore, as Mr. Wallace subsequently pointed out,† fails to take into consideration the fact that each butterfly produces not only one, but numerous offspring, that the right variation has, by the hypothesis which he combats, a greater chance of surviving than the rest, and that at each succeeding generation, the influence of heredity becomes more and more powerful, causing the chance of the right variation to become greater and greater. He also appears to forget that this imitation in butterflies is of comparatively rare occurrence, and that the mimickers generally belong to genera which naturally show a tendency to depart from the normal coloring of their own family and to approach that of the mimicked, so that the first steps are greatly facilitated. I consider therefore that the mathematical objection utterly falls to the ground; but that there is something in the closing ideas which Mr. Bennett throws out, which may yet lead to important discoveries, I can very well conceive. Indeed it must be rash to deny some such influence as he describes when we reflect upon the extraordinary power which the mind of the mother exerts, during pregnancy, on her offspring; and when we further consider that Mr. Wallace himself admits that man's present mental and physical condition could not have been brought about by natural selection alone. It must be obvious to every one, however, that such an admission is no argument against the theory of Natural Selection. All other modifying influences though they may lessen her potency simply assist her in her grand work.

The next objector we find in Mr. Saml. H. Scudder of Boston, Mass.,‡ who, while admitting that there can be no possible doubt of the fact of mimicry, questions its advantage among butterflies, since the greatest destruction occurs in their preparatory states. But as he refers especially to the two butterflies we have been treating of and as from the context it appears that he is also aware of the existence of some of the parasites which I have described, I will quote the greater portion of his letter which was written from Cairo, Egypt, under date of November 9th, 1870; and, will afterwards reply to his objections:

> "But of how much actual benefit to the mimetic species is this so-called "protective" resemblance? It seems to occur where it can be of the least possible advantage to the species. The great sources of destruction here, as in all groups of animals, are in early life. How large a proportion of the eggs that are laid by butterflies ever finally produce imagines? Let those answer who have attempted to follow their history in their native haunts. My experience leads me to believe that at the very least, nine-tenths—perhaps ninety-nine hundredths—never reach maturity. Hymenop-

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*A most remarkable case came under my notice the past summer. From a single batch of flattened and ribbed eggs, overlapping each other under a piece of Hickory bark, I succeeded in raising eighteen imagines of *Catocala phalangea*, Guen. The upper wings vary greatly in the individuals, and in one specimen the ground-color and markings are so very aberrant, that there is more difference between it and some of the others belonging to the same batch, than there is between the latter and a dozen distinct species.

†*Nature*, III, p. 49.

‡*Ibid*, Vol. III, p. 147.

terous and Dipterous parasites beset them at every step. The eggs, although so small and often so heavily ridged, cannot escape the ovipositors of the tiny Pteromali, while in attempting to breed caterpillars taken in the field, the chance is so greatly against the evolution of a butterfly, that Hymenopterists actually choose this method of supplying their cabinets. 'Of two hundred larvæ of *Pieris brassicæ,*' Mr. Drewsen, of Denmark, writes to me, 'I obtained only twenty pupæ, all the rest were attacked by *Microgaster glomeratus,* and my own attempts with the larvæ of *Pyrameis Atalanta,* both in America and Europe, have been even more unavailing. These caterpillars seem to be peripatetic banqueting halls of Microgasters and Tachinæ.

"Now it is a curious fact that while the globular egg of *Limenitis Misippus,** with its deeply-pitted shell, defended by long filamentous spines, is constantly attacked by parasites; and the grotesque hump-backed, strangely-colored caterpillar of the same species is likewise infested to an extraordinary degree, I have been unable to discover by very careful search any evidence that the egg or larva of *Danais Archippus* is ever pierced by a parasite; yet the egg is not small and only lightly ribbed, and the caterpillar large, fleshy, smooth-skinned, and gaily banded, living on the widely-separated leaves of Asclepias, with no attempt at concealment. The abundance of the imago of the Danais is then due quite as much to the immunity of the egg and larva from the attacks of parasites, as to any freedom it may itself enjoy from pursuit by insectivorous birds. [1.]

"Although I have hunted butterflies for fifteen years, I confess I have never seen one in a bird's bill, and my faith in that method of lessening their numbers is very slight. Birds, too, must be their greater foes in earlier life; and the chances of living, which are certainly against them before they take wing, seem afterwards rather in their favour, at least, until they have accomplished their mission. [2.]

"If, then, such an extraordinary element as Mimicry is to be summoned to the aid of Natural Selection, and can perform its task in such a masterly manner, why has it been made to waste its energies upon unimportant material? If the object of the resemblance be protection, why does not the unfortunate caterpillar of the Limenitis mimic the more favoured larva of the Danais? [3.]

"I cannot now consult the writings of Messrs. Wallace and Bates, nor do I remember their statements respecting the abundance of the mimetic species compared to that of its normal congeners. In my own country *Limenitis Misippus* is, as a general rule, more common than *L. Ursula,* but the difference in their numbers is not very marked. It is by no means as great as one would expect had Mimicry in the imago state so strong a protective power as has been assumed. [4.] Two closely allied species occupying the same geographical area, do not often occur in the same abundance, whatever be the cause, and the disparity in numbers in these two species of Limenitis is no greate than occurs in many instances where mimicry plays no part. [5.]"

[1.] No one will deny the facts, after what I have already set forth.

[2.] Such an experience from a butterfly hunter surprises me Individually I have on several occasions seen butterflies captured by birds, and have seen Dragon-flies dart after them. Any amount of evidence might be collected on this head, and Mr. Scudder has already been answered by Mr. Arthur G. Butler† of the British Museum, who mentions often having seen birds catch and devour the unprotected species upon the wing, while he has received abundant evidence respecting the immunity of the *Danais* group. "T. G. B." of St Johns College, Cambridge, has also often seen the common English sparrow capture *Vanessa urticæ* and *Pieris rapæ*‡; while Mr. Wallace has shown that great numbers of butterflies are destroyed on the wing by insectivorous birds such as jacamars, trogons and puff-birds, and gives conclusive evidence that while our Disippus congeners, the *Nymphalidæ*, suffer such persecution, the Archippus congeners do not.§ Thus, though there

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*The reader must bear in mind that *Misippus* is but a synonym for *Disippus.*

† *Nature* III, p. 165.

‡ *Ibid*, p. 166.

§ Contributions, etc., p. 79.

seems to be no record of any person having actually seen a bird or other animal attack the species of *Limenitis* in this country, there is every reason to believe that they will do so. This fact once being admitted, it must also be admitted that the resemblance of *Disippus* to *Archippus* serves the former as a protection. I freely grant however, that the species of *Limenitis* are kept under by enemies far more in the preparatory states than in the perfect state; but this fact only adds importance to the mimicry of *Disippus* as throwing light upon its greater numbers. The larvæ and pupæ of *Ursula* and *Disippus* so closely resemble each other that it is not likely their enemies would make any discrimination between them; and if in a given district where *Archippus* is abundant, the two former species, by the undue multiplication of their enemies in some particular year, should be so thinned out while in the immature states, that only a dozen imagines of each were perfected in an area of say 100 square miles; it becomes obvious that by deceiving the birds, or by associating with *Archippus*, the twelve specimens of *Disippus* would stand a much better chance of escape than those of *Ursula*, and that consequently more would succeed in perpetuating the species.

[3.] Natural Selection *does not*, therefore, waste its energies upon unimportant material, in giving protection to the perfect insect; and any one, with a little reflection, will perceive that there are the best of reasons why the unfortunate caterpillar of *Limenitis* cannot mimic the more favored larva of *Danais*. *They never come in contact!* The perfect insects are enabled by flight to associate together; but their larvæ—the one being confined to plants of the Willow and Poplar families, the other strictly to those of the Milkweed family—can never so associate. That there is, however, an effort at protection in the preparatory stages of *Limenitis*, no entomologist who has studied them in the field will deny. The egg, as Mr. Scudder has admitted, is in a measure protected by the long filamentous spines, which may protect it from the attacks of some of the very numerous parasites that might otherwise aid in exterminating it. The larva is very variable, and wears a remarkable protective resemblance to its surroundings. I have often noticed that in the mature specimens found on the dark Scrub willow the dark colors predominate; that those found on Golden willow are much brighter and greener, and the palest specimen I ever saw was found upon Silver poplar. Only those who have diligently searched for these larva can fully appreciate the protection which their appearance affords. In one instance I chanced to espy a large full grown specimen of *Disippus* on a Golden willow not more than seven feet high. The specimen on account of its brightness and greenness struck me as remarkable, and I searched for others. In taking a casual glance I could detect none, but after a diligent search I succeeded in finding seven specimens, and then left, fully convinced that I had espied every one upon the tree. The next day, however, my confidence in the sharpness of my eyes was considerably shaken, for upon returning to the same small tree I succeeded in finding three more, all of them more than half grown.

As to the chrysalis, it bears a very strong resemblance to a bit of bird dung, and for the first few hours of its being, while the parts are yet soft and elongated this resemblance is truly striking.

[4.] I have shown that the disparity in numbers between *Disippus* and *Ursula* is very marked in the Mississippi Valley, and there is every reason to believe that the former is most abundant wherever its protector, the Archippus butterfly, abounds. I have Mr. Scudder's own authority for the statement that the latter is comparatively rare in the northeastern States, and my own experience would indicate such to be the case. Now it is extremely probable that where *Archippus* abounds, birds and other natural enemies are continually reminded of its nauseous qualities both by smell and taste.*

It would very naturally follow therefore, that where *Archippus* is rare, birds would not be so continually warned of its evil properties, and the deceptive resemblance in Disippus would lose much of its protective power in such a case. This explanation of the fact that *Ursula* is in some districts more common than *Disippus* will acquire greater force, if we find that such a state of things occurs only where *Archippus* is rare, and the facts as they at present stand indicate such to be the case.

Mr. Wallace† is inclined to account for the fact that *Ursula* is in some districts as numerous, or more so than *Disippus*, on the supposition that *Ursula* is also a mimicker, resembling the Philenor swallow-tail (*Papilio philenor*, Drury‡) especially on the underside, which is exposed when the insects are at rest. We must, however, be very cautious in accepting such resemblances as cases of mimicry, without first ascertaining whether there can be any real cause for mimicry or whether the two butterflies ever associate together. Under the circumstances I incline to believe that the markings on the underside of *Ursula* are of a generic character since they obtain in other N. A., species of *Liminitis*; and that the resemblance to *P. philenor* is merely casual and bears no more relation to mimicry than does the close resemblance of certain plants belonging to different continents. *P. philenor* is itself a rare insect where *Ursula* is common, and must always be so on account of the scarcity of its food-plant; and, if anything, *Ursula* bears a greater general resemblance to *P. troilus*, Linn, and *P. asterias*, Drury, which are both more common species. It also bears a greater resemblance upon the upper surface to the female of *Argynnis Diana*, Cramer.

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*A singular fact bearing on this point has been communicated to me by Mr. Otto Lugger of Chicago, a gentleman who takes much interest in entomology and is a good collector. While employed on the U. S. Lake Survey he once saw a bird dart after an Archippus butterfly, seize it and immediately drop it without devouring the body. The butterfly dropped close by his side and he picked it up and examined it, and had no means at the time of accounting for the singular action of the bird.

† *Nature* III, p. 166.

‡ See my 2nd Rep. Fig. 86.

[5] This in no wise alters the fact, however, of the existence of mimicry in *Disippus*, which Mr. Scudder fully admits. It is, therefore no argument against Natural Selection having produced such mimicry. Because we are able to explain the principle power working to produce the relative abundance of one species, compared with another that is closely allied, it does not follow that we must also give the varied influences which cause the relative abundance or rarity of other species in other groups!

The third objector is Mr. A. Murray, who undertakes to show that these mimctic resemblances have nothing to do with Nnaural Selection.* He takes it upon himself to assert that every inch of ground which Mr. Bates has gone over is "mined and unsound"—that the "bad smell has not been observed in North America where similar mimicry occurs"; and that "birds and insects of prey hunt by sight and not by smell." Any one who will take the trouble to carefully read the paper in which these assertions occur, will, I have little doubt come to the conclusion that it is the author's ground which is "mined and unsound." The second assertion, as I have already shown, is false; and even if the third is admitted, it does not in the least affect the argument in favor of Natural Selection, because the fact nevertheless remains that some groups do enjoy immunity from the attacks of birds while others do not. The manner in which Mr. Murray would account for this mimicry is by hybridization, and he endeavors to draw a parallel between the phenomenon and hybridization in plants. He carries little weight in his arguments, which were in a measure anticipated by Mr. Bates himself, and have since been refuted by Mr. Butler and Mr. Wallace.† He forgets that hybridization cannot play any part in the mimicry of insects to the vegetable kingdom, or to backgrounds generally. It has never been known to occur between insects of different Orders, families, or even genera, and produce fertile offspring,‡ while mimicry does occur even between insects of distinct Orders; and though he of course supposes the hybridization to have taken place at a very remote date, when the structural characters of the mimickers and mimicked were less specialized, yet had such been the case, these structural characters would not now remain so distinct between them, because it is quite fair to suppose that the hybrids would partake of the characters of each parent. Indeed the assumption of the theory is unsupported by facts. He ignores in a measure the great difference in the affinities of species belonging to the natural Orders of plants, and those belonging to the Orders of insects, and depreciates the importance of the latter by comparing the Orders simply to families in other animals—thus showing that he has not a due appreciation of the true affinities of insects.

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* *Nature* III, pp. 154-6.

† *Ibid.*, III, p. 165.

‡ Cases of hybridization even between species of the same genus are very rare, and it is doubtful if the hybrids would ever be fertile; and as to hybrids between genera I do not think a case has ever been recorded. In 1865 I succeeded in obtaining thorough coitus between a ♂ *Attacus cynthia*, Hubn., and ♀ *Attacus cecropia*, Linn., but for some reason the eggs resulting from this intercourse did not hatch. Last year I succeeded in producing an equally thorough coitus between a ♂ *Attacus cecropia*, Linn., and a ♀ *Attacus polyphemus*, Linn., but the eggs subsequently deposited by the latter were likewise infertile.

It must not be forgotten that Natural Selection is not the only power at work producing this mimicry. This we do not claim. There is an inherent tendency in all things to vary—a fact universally admitted. We may not be able to fully comprehend the causes producing this first variation, for they are complicated, and depend on numerous external conditions, and physical and mental influences. But our ignorance in this respect does not affect the theory, because "spontaneous" change is the material out of which Natural Selection has fixed and perfected the mimicry and adaptation; and it is not necessary to know how the "spontaneous" change is produced to learn the origin of the mimicry. Whatever be the causes of variation, and whether or not they continue to act after the first change takes place, Natural Selection is still potent, for the change would be perfectly inoperative in producing specific character without it.

There may be a hundred different influences that have led *Disippus* to mimic *Archippus*. The resemblance being purely colorational, there may have been a tendency from the first in the color of the former to approach that of the latter, and this is rendered very probable from the fact that the red-brown color occurs more or less in all the N. A. species of the genus.* The very smell which protects *Archippus* may have had, and may still have, attractions for its mimicker, for Mr. Henry Edwards found that a Californian species of the same genus (*Limenitis Bredowii*) was greatly attracted by any offensive odor.† Again, when we reflect that we owe so many of our flowers and fruits to what are called "sports," which are simply instances of great and sudden variation; it is not difficult to imagine that the mimicry of *Disippus* may be due in a measure to some such sudden original variation—an idea that is greatly strengthened by the fact that instances of such great variation are common with butterflies and moths, and that one is known to occur in the very genus *Limenitis*.‡

We may give due weight to the somewhat Lamarckian theory advanced by Mr. Bennett; we may attach the greatest importance to the influence of physical conditions—and we know that similar habitat sometimes produces modification of allied forms in a similar direction—but all these agencies will not produce specific imitation of one species by another, for they only prepare the way for it. It is therefore quite evident that such imitation can only be brought about to use Mr. Bennett's own words, "by the continuous preservation, through countless generations of those individuals which spontaneously approach most nearly to the ultimate forms;" and Natural Selection is the Preserver.

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* In the seven described N. A. species of *Limenitis*, namely, *L. disippus*, Godt., *Ursula*, Fabr., *Proserpina*, Edw., *Weidemeyerii*, Edw., *Arthemis*, Drury, *Lorquini*, Boisd. and *Bredowii*, Hubn. the red color obtains more or less in all of them, especially on the under side, and this is more particularly the case in the last two. I also possess specimens of *Ursula* in which a very distinct shade of red blends with the blue-black and spreads over the upper surface of the primaries, and is in two individuals quite marked towards the apices. That the blue and black is closely connected with, and shows a tendency to affiliate with the brick-red and black, or *vice versa*, we may also reasonably infer from the wonderful contrast existing between the ♂ and ♀ *Argynnis Diana*, Cram., the former colors obtaining in the ♀ and the latter in the ♂.

† *Butterflies of North America*, by Wm. H. Edwards. It is impossible to make any explicit reference to this beautiful work as it is not paged: this, to my mind, is a deplorable oversight.

‡ *Limenitis Sibylla* figured in "Newman's English Butterflies," and referred to by S. N. Carvalho, Jr., in *Nature*, Vol. III, p. 66.

I have thus endeavored to frankly consider the objections raised against the theory of Natural Selection, as it applies to the mimicry of our two N. A. butterflies. It would be out of place here, and might justly be considered a work of supererogation on my part to undertake to defend it on more general grounds. It has been so well developed by Darwin, Wallace, Bates, and many other writers, both English, French and German, that it only asks a hearing to be understood and appreciated. The rapid increase of organisms is demonstrable, and the consequent struggle for existence, since, all organisms considered, there are as many deaths as births, is manifest. The result of this struggle is the survival of the fittest, by which organic forms are constantly changing to keep in harmony with the changed conditions which it is demonstrable have taken place, and are still taking place, in the inorganic world. And, to use Wallace's language, "as the changes of conditions are permanent changes in the sense of not reverting back to identical previous conditions, the changes of organic forms must be in the same sense permanent, and thus originate species."

That its influence and importance has been overrated by some writers is not at all unlikely, for Mr. Darwin himself now believes *that* he at first attributed too much to its action; and certain it is that it could have had no influence in producing many purely ornamental features of certain animals, that are of no use to the species thus ornamented. No theory was ever yet propounded, however, which has so well stood the test of scientific investigation in all departments of research, or that has such a power of absorbing new facts; and no theory has in such a short time been so very generally accepted by the leading scientific minds.

A two-fold reason has led me to give it prominence in this Report. First, I believe that when well understood it must prove of the utmost importance to the husbandman, by giving him an intelligent conception of the growth and development of animal and plant life about him, and by adding zest and interest to his efforts to produce superior varieties and breeds. Secondly, my studies of insect life led me several years ago to appreciate the hypothesis, and the more I become acquainted with these tiny beings in the field, the more I become convinced of its truth and importance. It is not to be wondered at that the entomologist who treats the different varieties in any group as independent species, should have implicit faith in the absolute distinctness and immutability of species; but whenever he pays more attention to the biological part of his science, and studies insects more in the field, his views must necessarily change. Indeed, next to plants, insects offer, perhaps, the best material for the inquiring mind to work upon. Their rapid multiplication, the rapid manner in which one generation is often followed by another, the wonderful manner in which they are often affected by climate and food, especially during the preparatory or adolescent stages—all tend to furnish variation for Natural Selection to work upon, in a profusion unknown in the higher animals. Though the formation of a species in the other Classes of animals may never be in man's power to trace, on account of the great lapse of time required; it seems highly probable that the process may some day be traced in insects, and Mr. Bates gives strong proof of the derivation of one butterfly (*Heliconius thelxiope*) from another (*Heliconius melpomene*) and a clear insight into the manner in which the gradual modifications take place, till at last the two forms cease to interbreed, and are in every sense of the word true species.*

After all, the great objection to the theory of Natural Selection, in the minds of many, is, that it involves belief in the broader doctrine of Development—of Evolution. Very true! But, no matter how much importance be attached to Natural Selection, the fundamental truth of the development of species is now almost universally accepted by scientific men best able to judge of its merits; and those who have not considered the subject may be excused from judging of it. Indeed it can hardly any longer be considered a hypothesis: it is in reality established as a law, and as eminent a naturalist as Carl Vogt has even ventured the assertion that "no one in Europe dares any longer sustain the independent and direct creation of species." Development is a fact in nature, and the revelations of science strengthen faith in the universality of her laws and principles. No one can study well the facts in natural science, or the truths of philology, which point to corresponding results, without feeling more strongly than ever words can express, the general truth of the doctrine. Our own Agassiz is about the only great naturalist who opposes it, though it is rather significant that many of his leading pupils have, within the last few years, boldly proclaimed their faith in Darwinism. If there is one error in Agassiz' life, I take it to be the authority which he has lent to that popular prejudice which has always opposed inquiry into the order of nature, and which has ignorantly accused Darwin of atheism.

A theory which is so opposed to deep-set tradition and to present theological interpretations, must necessarily at first meet with very great objection. Such has been the history of all great scientific truths, for we have Agassiz' own words that "the history of the sciences is present to tell us that there are few of the great truths now recognized which have not been treated as chimerical and blasphemous before they were demonstrated.' Truth must, however, in the end prevail!

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*Naturalist on the River Amazons, Vol. 1, pp. 255–265.

Science and theology have little in common, and will, perhaps, always be at variance, but science and true religion are twin-sisters, and will ever go hand in hand. In the present question, theology affirms supernatural causes beyond man's investigation, and consequently sets an embargo on inquiry; while science affirms natural causes within the limits of investigation: the one appeals to man's senses, the other appeals to man's reason, whose throne should never be abdicated, and whose power to trace effects to antecedent causes is unlimited.

The belief that Darwinism is irreligious and atheistic, is widespread; but this belief is the direct result of prejudging and unfounded prejudice. For no one who understands the theory can entertain such an idea for a moment. The individual is not created by a special miracle, but develops by natural means. Yet no one would claim that the individual was any the less a creation. And so when it is argued that species also develop by natural means—according to natural law; they are none the less therefore creations! It is only a question as to the method which the Almighty employs; for not only does the development hypothesis imply an Infinite cause, but to use Prof. E. L. Youman's language "its conception is as much grander than the common theological idea, as the conception of the Cosmos which science has revealed, transcends the petty ideas of the world which were entertained in the grovelling infancy of the race!" Creation by a process of development is tangible and conceivable, whereas we can have no knowledge and no conception of creation without any process.

Haeckel, one of Darwin's strongest supporters, says: "In recognizing the unity of nature and the efficacy of the Divine Spirit in everything, we may perhaps lose the hypothesis of a personal Creator, but we evidently gain the idea of a Divine Spirit, which pervades the whole universe. God is the highest, the most living, the most active unit through all things which only appear as sensuous representatives for sensuous creatures." Can such men be called atheists or materialists?

The supposition that the creative mind produced all things as we now find them, by a single act of unstinted power, requiring only such time as can be reckoned by ourselves, is the direct outgrowth of our own comparatively feeble minds—is to gauge the power of the Almighty by our own. The supposition that he works through natural law, originally ordained, and by a constant exercise of his prerogative, is a far higher and more comprehensive conception; for it helps to broaden our views and enables us to grasp something more than we have hitherto done. It carries us back æons in the past, and shows us that creation has not only been continuous but still endures, and it helps us to rise to sublimest contemplation of that unknown Infinity which pervades all.

Von Baer has truly remarked that "the scientific investigation of Nature strives to learn everything in detail, in order to get nearer to the cause of everything," and though we may not always reach the goal we aim at, we should not therefore cease to try. The law of the age is progress, and the point we reach to-day will form our starting point to-morrow. Every step which enables us to more truly interpret the workings of the Divine Mind in nature, necessarily brings us nearer to, and gives us a more intelligent idea, of a Creator. Each new insight into the significances and harmonies around us, helps us to lift the mystic veil and behold with awe and wonder the might and majesty of God—to converse with him as flesh with unknown Infinity; and I look forward to the day when the development of species will not only be universally recognized as a law, among naturalists; but when the liberal-minded theologian will revere the names of men like Darwin, who help to a higher conception of creation—instead of anathematizing them and ignorantly charging to their doctrines those atheistic tendencies which in times past have been vainly thrown up to those of so many other great, clear-thinking, discovering minds!

ERRATA.

Page 7, line 18 from bottom, for "*Hyleœctus,*" read "*Hylecœtus.*"

Page 57, line 18, add "*c*" before the first "*h.*"

Page 58, line 2 from bottom, for "*fornudolosus*" read "*formidolosus.*"

ERRATA OMITTED IN THE FIRST REPORT.

Page 14, line 16 from bottom, for "females" read "males." Page 30, note, for "F" read "T." Page 32, line 14 from bottom, for "III" read "V;" same page, line 7 from bottom, for "XIII" read "VIII." Page 38, line 5, for "*Tredeim*" read "*Tredecim.*" Page 53, line 19 from bottom, for "laid" read "lain." Page 54, line 4 from bottom, for "hatch" read "are deposited." Page 87, line 11 from bottom, for "F" read "T." Page 132, line 16, for "*ampelopsis*" read "*ampelopsidos.*" Page 150, line 6, for "ruddy" read "vigorous;" same page, line 26, for "*thyridopteryx* read "*thyridopterygis.*" Page 154, in the heading, for "*zeas*" read "*zeæ.*" Page 155, line 13 from bottom, for "zeas" read "zeæ." Page 173, line 3 from bottom, for "it" read "the more liquid parts;" same page, under the heading, read ("Lepidoptera, Tineidæ.") Page 174, line 3 from bottom, for "*Solidaga*" read "*Solidago.*" Page 175, line 32, add "front" before "wing." Page 178, lines 2 and 3, for "*gelechia*" read "*gelechiæ.*"

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